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The Patent Situation

Some profound changes in the Patent situation have been brought about by the conclusion of hostilities, chief amongst which is the withdrawal of permission by the allied nations to utilise each other's protected processes and machinery. Good use has been made with of Patents in recent years by the various nations at war with the Germans and Japanese, but now stock must be taken of the existing conditions or otherwise actions at law can arise. The position of enemy-owned Patents is not yet clarified, but where exclusive licences have been granted to British concerns, the position is much the same as if that Patent were British-owned. It is the general belief amongst British technicians that the present laws are inadequate and the need for a new system is imperative. The cost of Patent legislation is beyond the means of the private individual possessing a moderate income, whilst the outcome of a case is often problematic, due not to the novelty and intrinsic merit of the invention, but to some lack of clarity of expression or restriction in the claims advanced. Again, the inventor is handicapped because of the search which goes back 50 years—a period capable of prolongation by the recently published citation of earlier applications with appropriate comment. It is obvious that some of these old-time applications were based on inadequate experiment and reasoning by analogy. Into the last category, there often enters a number of false premises, brought into relief by later research, yet they are sufficiently clear to anticipate a true invention. Again, before the development of electric motors, ball bearings, and precision engineering, a number of the older inventions were impracticable.

A commission is now in being to make recommendations for changes in the law and we hope that ways and means may be established which will give adequate protection of novel processes and machinery at a reasonable cost for both protection and maintenance in law. To our mind the Commissioners would do well to devise two codes of laws—one to cover plant and the second materials and processes, as we believe that much of the complexity now existing is due to an endeavour to "kill two birds with one stone." If the two sections are inextricably bound up with each other, then the issue of two separate Patents should meet the case. At the moment there is far too often a hopeless mix up of the two sides in order to widen claims for things undreamt of by the inventor. After all, a Patent should be for an invention which the applicant visualises and not a draft on developments of industry of which the inventor knows nothing. For instance, if a man invents a moulding machine and couples it with the process of making castings and later learns that it is useful for the manufacture of trucks or plastics, then he should have no redress. On the other hand, if he is content to patent the machine alone, then no matter what industry uses it, the user must acquire a licence.

Process Patents are more difficult to handle, and the law needs very special direction as to the provisions for the granting of a monopoly. Where a plant specification can be put forward to meet the case it would in most instances be preferable. We are unaware if Siemens patented a steel-making process or not, but protection based on a regenerative open-hearth furnace would have served equally well, as it would have also covered glass-making and other applications. The future, however, will see that the already high percentage of applications emanating from the research laboratories of the large manufacturing concerns will be increased. In many cases there is a sort of commercial "Trespassers will be prosecuted" notice to prevent small fry from entering upon their preserves.

Contents

The Patent Situation, 281.—Forthcoming Events, 282.—"Steam," 282.—Enamelling Aluminium, 282.—Some Initial Results on the Influence of Tellurium as a Chill-inducing Medium in Cast Iron, 283.—Holding Down Loose Pieces, 288.—Gas-filled Plants in the Vitreous Enamelling Industry, 288.—Moulded Pattern Plates, 289.—Notes from the Branches, 290.—Metals at High Temperatures, 291.—Basic Open-hearth Slags, 292.—Low-Frequency Induction Furnaces, 293.—Aluminium and the Automobile Engineer, 295.—Nickel Control Ends, 295.—£50,000 for Metallurgists, 296.—Foundry Control, 297.—South African Foundrymen in London, 298.—Wallwork Gears, Limited, 298.—Metallurgy Division of the Royal Aircraft Establishment, 298.—Toy Dies, 298.—Special Act Concerning Income Tax, 299

FORTHCOMING EVENTS

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

MARCH 15.

Keighley Association of Engineers:—"Wheels behind the Wheels" (film). At Devonshire Buildings, Devonshire Street, Keighley, at 7.30 p.m.

MARCH 18.

Sheffield Society of Engineers and Metallurgists:—"The Modern Direct Hydraulic System," by F. H. Towler. At the Royal Victoria Station Hotel, Sheffield, at 6.15 p.m.

MARCH 21.

Staffordshire Iron and Steel Institute:—"Malleable Cast Iron," by H. G. Hall. At the Dudley and Staffordshire Technical College, The Broadway, Dudley, at 7 p.m.

MARCH 22.

Institute of Vitreous Enamellers:—Quarterly meeting.

Manchester Association of Engineers:—Annual general meeting; "Current Trends in Road Transport Vehicle Design," by D. H. Smith. At the Engineers' Club, Albert Square, Manchester, at 6.45 p.m.

MARCH 23.

Institute of Vitreous Enamellers:—Quarterly meeting.

APRIL 5.

Institution of Mechanical Engineers:—"The Evolution of a Tank Transmission," by H. E. Merritt. At Storey's Gate, St. James's, Park, London, S.W.1.

APRIL 10.

Institute of Welding (West Scotland branch):—"Fabrication and Welding of Bridging Equipment," by R. G. Braithwaite. At 39, Elmbank Crescent, Glasgow, C.2, at 6.30 p.m.

APRIL 11.

Institute of Welding (N.E. Tyneside branch):—"Mild Steel Weld Metal from the Point of View of 'Snow Flakes,' Porosity, etc.," by H. F. Tremlett. At the Mining Institute, Neville Hall, Newcastle-upon-Tyne, at 6.15 p.m.

Staffordshire Iron and Steel Institute:—"Hardness and Hardenability of Steels," by H. A. MacColl. At the Dudley and Staffordshire Technical College, The Broadway, Dudley, at 7 p.m.

Institute of British Foundrymen

MARCH 21.

East Anglian section:—"Some Casting Troubles," by J. L. Francis, A.M.I.Mech.E. At the Central Library, Northgate Street, Ipswich.

MARCH 23.

Bristol and West of England branch:—"The Foundry," by W. McCormick. At the Merchant Venturers' Technical College, Bristol, at 7 p.m.

Lincoln section:—"A Discussion of Problems in Jobbing Ironfoundries," by A. E. McRae Smith. At the Technical College, Lincoln, at 2.45 p.m.

MARCH 25.

Sheffield branch:—"Precision Casting by the Lost Wax Process," by Adam Dunlop. At the Royal Victoria Hotel, Sheffield, at 7 p.m.

MARCH 27.

Birmingham, Coventry and West Midlands branch:—"A Survey on the Mass Production of Small Steel Castings," by W. H. Bamford. At the James Watt Memorial Institute, Great Charles Street, Birmingham, at 7.30 p.m.

London branch:—"The Education and Recruitment of Foundrymen," by Dr. D. H. Ingall. At the Charing Cross Hotel, London, W.C.2, at 7.30 p.m.

MARCH 30.

East Midlands branch:—Annual meeting and short Paper competition. At the Technical College, Derby, at 6 p.m.

Wales and Monmouth branch:—"Production of Tank Wheels in a Mechanised Blackheart Malleable Foundry," by A. B. Bill and J. Peers. At Newport.

"STEAM"

From Our Scottish Reporter

At the luncheon after the showing in Glasgow of the Babcock & Wilcox film "Steam," Mr. C. K. F. Hague, the company's managing director, made a telling point. "British industrialists are being officially impressed that the country's policy must be 'export or expire,' but simultaneously the impression is too often officially fostered abroad that British industry is inefficient—dead from the feet up. Which is hardly calculated to make things easier for the British industrialist."

"Steam"—the best documentary of its kind, I think I have ever seen—was primarily designed for showing abroad in export markets, and copies are being made with spoken commentaries in Latin-American Portuguese and Latin-American Spanish. Copies are also being made with a commentary in Chinese.

Incidentally, Mr. Hague tells me that contact has been established with the Babcock & Wilcox allied company in Japan, but that it is the intention to close down there and establish instead a works in China. This seems not only just—but good business. China's future is more promising than that of Japan.

Contact has also been established with Babcock & Wilcox in Germany—but not, however, in Poland, where the plant is in the Russian zone. Presumably the Russians are operating it. I found Mr. Hague fascinating on the subject of air-zoning of territory in the conduct of the export business of his company. Air travel has revolutionised export, he declares; thus, it is now the firm's policy to cover by air from two or three centres in South America all the vast territory in which their interests may lie, keeping in direct and constant touch with their various agents. From Mexico City, for example, twice within the past six months a representative has covered the Guianas, the West Indies, Venezuela, Colombia, Ecuador, Peru.

A similar policy is in operation in Latin-America farther south. In the old days, as Mr. Hague says, representatives would have been sent out from this country, after having bought all the paraphernalia of extensive travel, and their tour would have been almost in the nature of a "safari," with an inevitable time-lag between customers' desires and their fulfilment.

Air communication with its ever-growing ramifications, has changed all that—and British manufacturers concerned with export trade will have to readjust their ideas (if they have not already done so) to that fact.

ENAMELLING ALUMINIUM

The American concern—Du Pont—in co-operation with aluminium interests, is developing a new technique for porcelain enamelling of light alloy castings and sheet. Work is also being undertaken in this country. In this connection it is interesting to record that whilst in Berlin. Mr. A. McLeod, the Editor of *Sheet Metal Industries*, acquired a medal presented by the German Government to mothers of large families, and this was made from enamelled German silver—a fairly low melting point alloy.

SOME INITIAL RESULTS ON THE INFLUENCE OF TELLURIUM AS A CHILL-INDUCING MEDIUM IN CAST IRON*

Early attempts in this country just prior to the outbreak of war were made in an endeavour to develop the use of tellurium as a chill inducer in cast iron, but these were largely abandoned due to the difficulty of control experienced. In this application tellurium was finally looked upon more as a de-graphitising "curiosity" rather than as a potential means of a convenient and easily applied chilling or densening medium. By the continuation of these experiments, and by the successful and practical application of tellurium in this respect, on certain types of castings in the foundry with which he is associated, the Author is endeavouring to show that tellurium as a chill promoter is not just a "curiosity" but can be applied in practice, although as yet only to a limited extent.

Tellurium is a transitional element classified in the sixth group of the periodic system with sulphur and selenium. It is a metal with an atomic weight of 127.5, a melting point of 452 deg. C., and a boiling point of 1,390 deg. C. It freezes in a characteristic columnar rhombic crystalline form (Fig. 1). The chief source of supply of the element is from the deposited slimes on the anodes in the electro-refining of copper and zinc. Being a member of the same sub-group as sulphur and selenium, it exhibits similar chemical properties, yielding thus a tellurium hydride (H_2Te). It is the low volatilisation point of the metal, together with the toxic properties of this gas, which largely constitute the difficulties experienced when used with cast iron with its somewhat higher furnace tapping temperature.

After a number of preliminary tests had been conducted, with the line of testing being varied, as partial success or failure indicated, three methods of introducing the tellurium into the iron suggested themselves as suitable for further examination: (1) As a direct addition to the ladle; (2) as a mould wash or lacquer; (3) mixed with facing sand.

These methods are discussed in the order in which they were investigated.

Direct Addition to the Ladle

Rough standardisation was obtained by using a pattern 8 in. by 4 in. by 2 in. for the test-blocks throughout. Varying percentages of tellurium technical powder were used ranging from 0.001 to 0.02. The powder was scattered loosely over the bottom of the ladle and the molten iron tapped or poured on to it. In practically every case the bulk of the tellurium was, due to its low volatilisation point, immediately lost, with the production of clouds of fumes. Additions of the powder towards the higher limit of the stated percentages merely increased the volume of the fumes evolved. The fracture of the test-blocks poured was that of the ordinary grey iron used, but occasionally a completely white fracture was obtained, and although the certainty of obtaining this white fracture when desired could not be ensured, it was noticed that it invariably occurred when the tapping temperature of the metal was in the lower range.

In view of the erratic results and of the irritant effect of the fumes evolved, the addition of the loose powder was discontinued, and a means of protected addition was tried. This consisted of enclosing the powder in thin copper foil, or in copper tubes, closed at the ends, in a manner similar to that in which several well-known non-ferrous additives are used, and adding them in the desired numbers to a cold ladle, prior to tapping. An immediate improvement in results was effected and fractures ranging from completely white, through varying depths of chill to mottled and grey, were obtained at random in the test-blocks. Here again, however, the results were erratic, due, it was considered, to the tendency when using low-temperature iron, for the copper capsule to float and only partially dissolve. From this, the melting point of copper was considered to be too high, and aluminium foil and tubes were substituted. This lower melting-point covering created a sufficient lag to ensure reasonable absorption, without permitting flotation and subsequent loss.

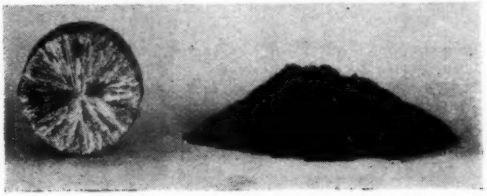

FIG. 1.—TYPICAL COLUMNAR STRUCTURE OF TELLURIUM METAL.

The procedure next adopted was with the view of ascertaining (*a*) the effect of varying percentages of tellurium addition, with a constant metal temperature; (*b*) the effect of varying temperature with a fixed amount of tellurium; (*c*) the effect of casting section on chill depth; (*d*) as in (*a*), (*b*) and (*c*) using different grades of iron.

Fig. 2 shows fractures obtained by pouring metal at approximately 1,350 deg. C. into ladles containing 0.02, 0.015 and 0.01 per cent. tellurium, a wholly white, ¼-in. skin chill, and a wholly grey iron, being obtained respectively. Fig. 3 shows fractures obtained when an

*Winning entry in a short Paper competition organised by the East Anglian section of the London branch of the Institute of British Foundrymen.

The Influence of Tellurium

addition of 0.02 per cent. tellurium was made to each ladle, with metal temperatures of approximately 1,240, 1,370 and 1,400 deg. C. The temperature of 1,240 deg. C. was not sufficiently high quickly to dissolve the foil and absorb the tellurium completely and a chill depth of $\frac{3}{16}$ in. only was obtained. The temperature of 1,370 deg. C. gave a mean chill depth of $\frac{1}{2}$ in. and that of 1,400 deg. C. a completely grey fracture. This latter result was anticipated, as in tapping at this, and every subsequent check at the same temperature, the copious fumes evolved, indicated complete loss of the tellurium to the air.

A step-block pattern was used for the fractures shown in Fig. 6, 0.02 per cent.; tellurium-treated iron at a temperature of 1,380 deg. C. as used for pouring, giving a wholly white fracture in the $\frac{1}{2}$-in. section, a $\frac{1}{4}$-in. mean chill in the 1-in. section and a thin skin chill in the 2-in. section. The illustrations shown, although picked with a certain amount of discretion from a large number of tests, are typical of the results obtained throughout.

During the run of all the tests, duplicate tests were made using various grades of iron, ranging from a soft grey to a high-duty iron. No material changes from the foregoing results were noticed whatever the grade of iron used, with the one exception that a high phosphorus gave, if anything, a slightly deeper chill.

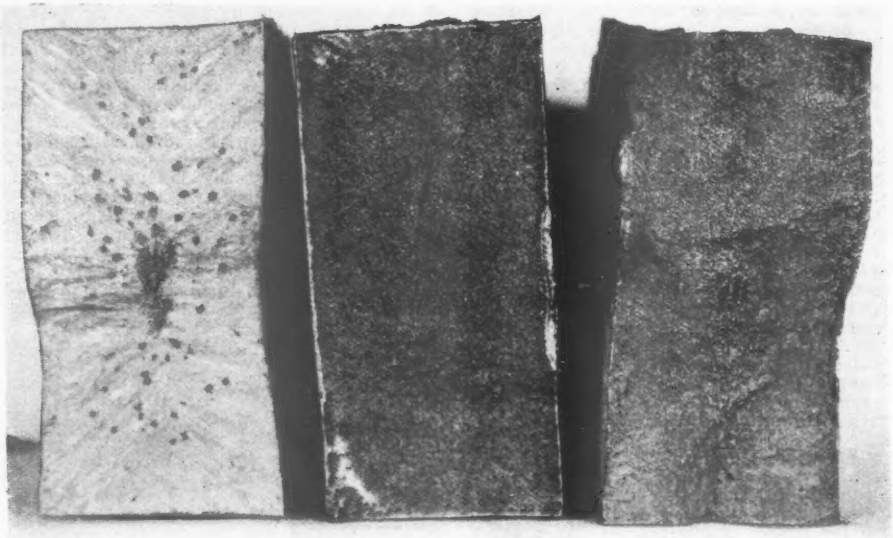

FIG. 2.—SHOWS FRACTURES OBTAINED BY POURING METAL AT 1,350 DEG. C. INTO LADLES CONTAINING 0.02; 0.015 AND 0.01 PER CENT. OF TELLURIUM.

Periodically it was found that in the higher temperature range there was a marked tendency for the tellurium in solution to rise from the test-block and up through the gating to air. Fig. 4 illustrates an instance of this when a completely grey fractured block was obtained at 1,360 deg. C., with 0.01 per cent. tellurium. The fracture of the ingates close to the block are shown as grey, while at the runner bar end they are considerably chilled, and the bar itself is completely white.

Following on this, Fig. 5 shows the "holding" effect of the more rapidly freezing of a 1-in. block compared with a 2-in. block when poured together from the same ladle.

Furthermore, in each case the grey iron visually unchilled by the tellurium was obviously densened to a marked degree and to a fair depth beyond that of the white chilled portion.

Mould Wash Suspended in a Suitable Vehicle

This method was the one attended by the greatest degree of control, and from the results obtained, the one ensured of the widest application. The first and obvious step to be taken was the providing of a suitable means of applying the tellurium as a lacquer. When mixed with water alone, and applied by brush to the mould face, insufficient suspension of the particles led to uneven washing, and a marked tendency

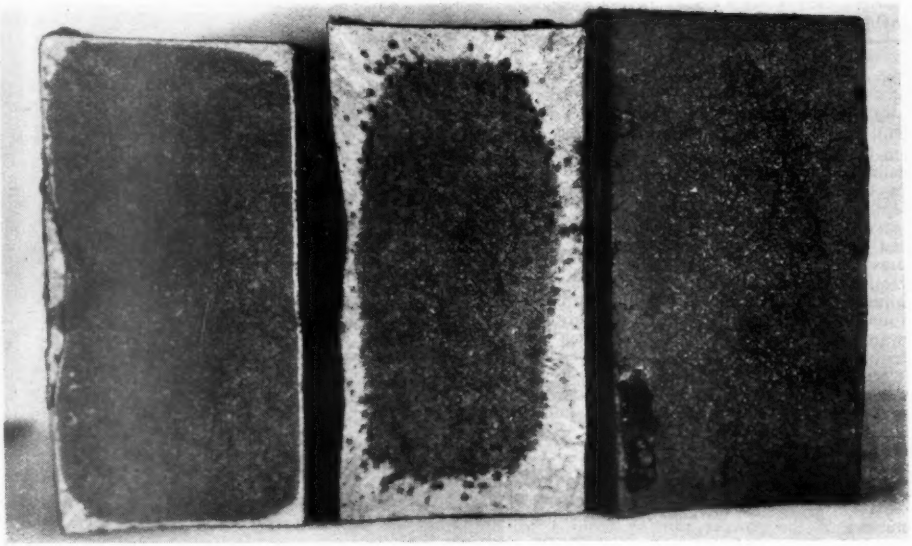

FIG. 3.—EFFECT OF AN ADDITION OF 0.02 PER CENT. TELLURIUM TO LADLE METAL AT 1,240; 1,370 AND 1,400 DEG. C.

for the powder to fall or be washed off when the mould or core face had partly dried. The addition of core gum to this made little improvement, and not until ordinary foundry blackwash was tried was the means of application considered satisfactory. This vehicle, as well as acting in its normal capacity as an inhibitor, and although one which entailed a loss of tellurium due to the surface powder only being in direct contact with the metal, had the necessary "body" to hold the tellurium in place during pouring. Percentages by weight of the tellurium power were tried, ranging from 1 to 20. It was finally adjudged that 10 per cent. imparted the deepest chill, upwards of that being shown merely to produce a mottled effect throughout the block, with no apparent increase in chill depth. Here again the temperature of the metal and to a lesser degree the percentage of phosphorus it contained had a controlling influence on the depth of chill. The hotter and more fluid the iron, the greater was the chill obtained, up to an apparent maximum of $\frac{1}{8}$ in. being obtained by this means.

Fig. 7 compares the fracture of an untreated block

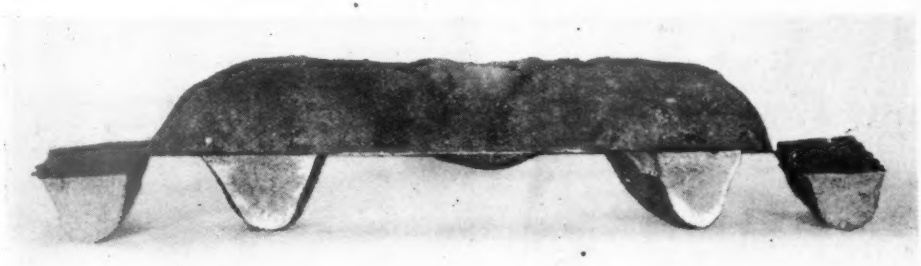

FIG. 4.—ILLUSTRATES HOW WITH HIGH TEMPERATURE POURING THE TELLURIUM TENDS TO "SWEAT."

The Influence of Tellurium

with that of a block which had been tellurium black-washed. Both blocks were poured from the same ladle, and, without taking into consideration the ¼-in. deep chill, the densening and refining effect of the tellurium in the treated block is very apparent. All test moulds poured, with the application of the prepared wash on any surface, gave a constantly even chill depth of from $\frac{1}{16}$ in. to ¼ in., with a B.H.N. of approximately 470. No penetration or flotation to unwashed faces of the moulds was discovered. Oil-sand cores coated with the tellurium wash and inserted anywhere in a mould showed on pouring and breaking for examination, and even chill of approximately $\frac{5}{32}$ in. round the core, with again no apparent tendency for upward penetration, a possibility which was at first anticipated.

Fig. 8 shows two fractured cast-iron eye-glass tensile test-pieces, one from a treated and the other from an untreated mould. On being pulled, the untreated bar yielded 16 tons per sq. in. and the treated bar 12.4 tons per sq. in.

Mixed with Facing Sand and Rammed in Light Depth over the Area to be Chilled

Percentages of the powder ranging from 1 to 20 were tried, mixed with ordinary greensand facing sand. On mixing it was found that an increase on the original moisture content was desirable, as the tellurium powder tended to cause a lack of cohesiveness, with a subsequent reduction in green compression strength.

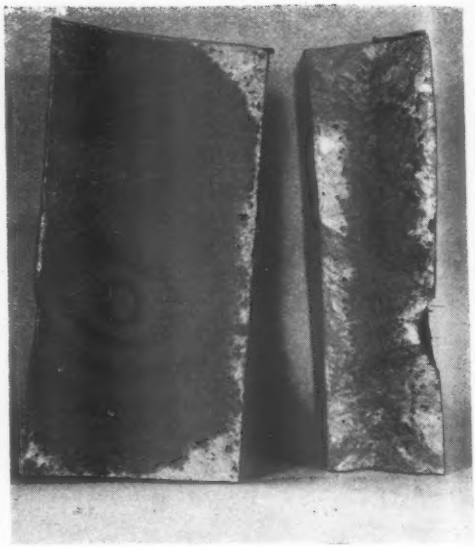

FIG. 5.—SHOWS THE HOLDING EFFECT DUE TO SECTION THICKNESS.

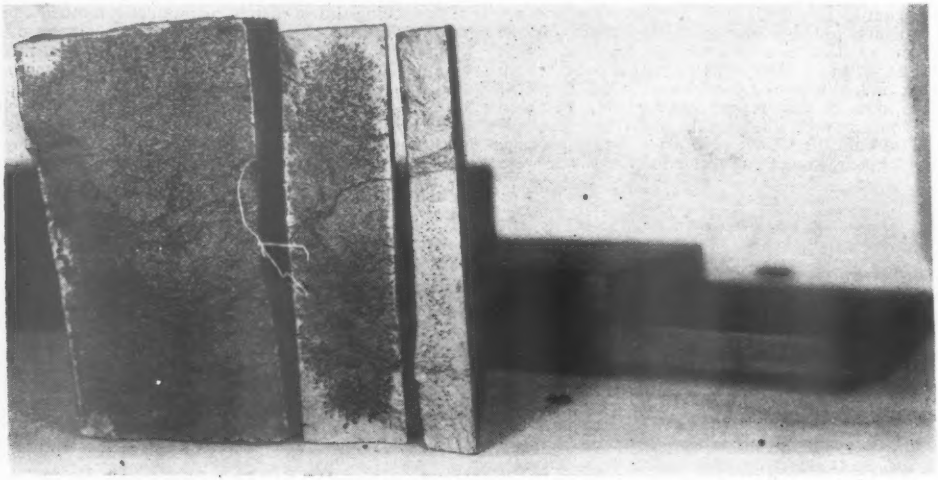

FIG. 6.—TYPICAL STEP BAR FRACTURES WITH 0.02 PER CENT. TELLURIUM.

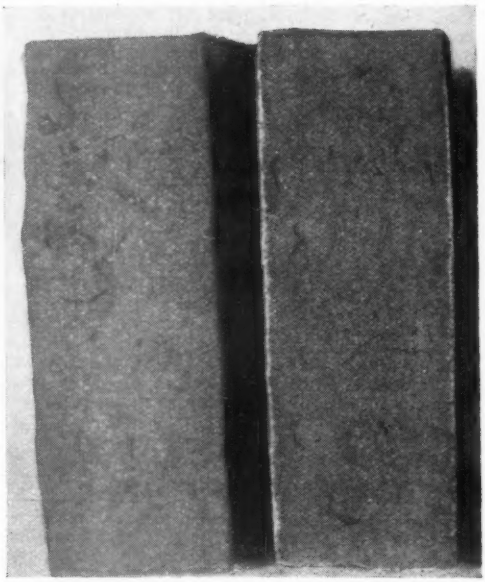

FIG. 7.—SAMPLES CAST FROM UNTREATED AND BLACK WASHED MOULDS.

Here again 10 per cent. was found to be the absolute maximum necessary to give the apparently greatest depth of chill obtainable by this means.

In an endeavour to reduce the large quantities of the powder used for this means of chilling, loose wooden blocks ¼ in. thick, sized and shaped to cover the area to be chilled, were fixed to the patterns. On moulding, the blocks were withdrawn and tellurium-mixed facing sand rammed firmly in their place. On casting it was noted that the longer a block or casting under test took to solidify, so in proportion did the depth of chill increase; but again only to a maximum of about ¼ in. ⅜ in. This advantage of a prolonged freezing period was off-set by the tendency for upward penetration to occur periodically on horizontal faces.

Summary

By protected additions direct to the metal it is possible to obtain any depth of chill approximating to that desired, but only by rigid control of all the factors involved, *i.e.*, the percentage added, the means of encasing it, the temperature of the metal used, and to a lesser degree its fluidity, and sectional thickness. Even on controlling these factors it has been found from time to time, and for no apparent reason, the expected chill has not materialised or has a greater depth than desired. If all the casting is desired white, this means of addition is ideal, but as this is seldom the case, and furthermore as it is seldom desired to have any depth of chill on all mould and core faces at once, the application of this process is very limited.

When used as a wash, however, tellurium has a very wide application, especially on faces or in sections where no machining is necessary. The use of tellurium in this respect is the foundry with which the Author is associated, in replacing previously metal-chilled heavy wearing parts such as sand-mill blades, and applied to castings such as cylinder covers, steam cylinders and other pressure castings of this type, where previously open metal led to leaking under water-test and necessitated bushing or even scrapping, has resulted in a very marked improvement in increased length of service with some, and denser metal, with its resultant pressure tightness, with others. The application of tellurium mixed with sand can again be wide, but in the majority of cases it need only be used for an inaccessable part of the mould, where the lacquer cannot readily be applied.

The Author expresses his thanks to the management of Reavell & Company, Limited, for the facilities granted for the carrying out of the tests.

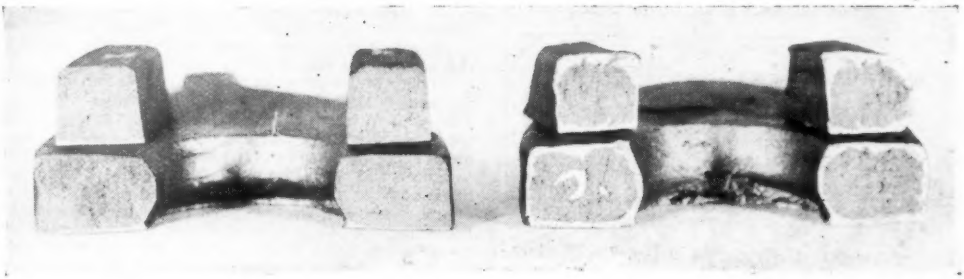

FIG. 8.—EYE GLASS TENSILE TEST PIECES CAST IN UNTREATED AND BLACK WASHED MOULDS, THE FORMER YIELDING HIGHER STRENGTH FIGURES.

HOLDING DOWN LOOSE PIECES

By "CHECKER"

The coremaker may frequently have to make cores out of coreboxes which the patternmaker has made with one or more loose pieces, to ensure the correct shape. These loose core pieces may be such that they can be withdrawn before the corebox is turned over and drawn off the core. Others, however, must be removed from the core only when the main frame has been taken away. Of these, many by virtue of their size and shape will not move out of position while the corebox is being drawn away from the

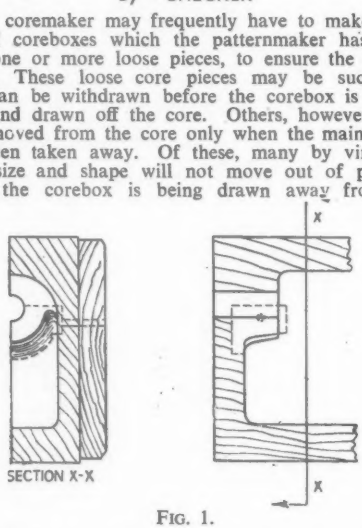

FIG. 1.

core. Occasions arise, however, when the size and contour make it wise and necessary to hold the loose pieces in their correct position in relation to the rest of the core, while the corebox is being withdrawn from the core, and so guard against the possibility of the loose pieces moving out of position, and thus producing a core which is not correct to corebox shape.

Fig. 1 shows part of a corebox with the loose piece shown by the dotted line, and, as will be noticed from the section XX, it is part of an internal boss with a small bore extending through to the outside edge of the corebox; the hole for placing the wire for holding down purposes is shown in dotted section

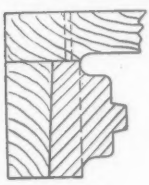

FIG. 2.

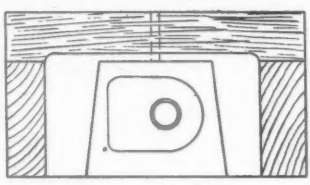

FIG. 3.

XX. Another example is shown in Fig. 2. The loose piece is an internal shape with a small print on its face required for positioning correctly another core. The position for the hole for holding down is shown dotted, and is also seen in Fig. 3, which gives the front view of the loose piece. It is usual to drill a hole of approximately $\frac{3}{16}$ in. in diameter, and it should be as near as possible in the centre of the base of the loose piece, or in such a position that the loose piece will not bind when the pressure is put on the wire to hold it in position.

With continual wear it will be noticed that the holding down wires will make an impression where they come in contact with the bottom of the loose

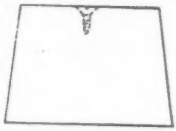

FIG. 4.

piece. These indentations may become as deep as $\frac{1}{4}$ in. or more, but by putting in a small screw with the head level with the bottom of the loose piece, as shown in Fig. 4, this difficulty can be easily and effectively overcome.

GAS-FIRED PLANTS IN THE VITREOUS ENAMELLING INDUSTRY

Referring to vitreous enamelling at a recent visit to the works of the Incandescent Heat Company, Limited, at Smethwick, by the Midland Junior Gas Association, Mr. J. Fallon, managing director of the company, said many major plants were being installed, all of which were town-gas fired. This was as it should be, as the bulk of the equipment produced in the furnaces was for gas, *i.e.*, gas cookers, etc. The greatest field for the increased use of gas, he considered, lay in dissociating the two functions of gas as fuel, namely, generating heat and providing a protective atmosphere, by utilising radiant heat and providing a conditioned atmosphere for the waste gases. There were possibilities for a much wider application of radiant tubes in both continuous and static furnaces in, for example, the vitreous enamelling industry, providing the economics could be brought into line. In the United States, the percentage of electric furnaces was much lower than in this country, because gas was cheaper, in addition to which an electric furnace had to have a gas-conditioned atmosphere, and desulphurisation of the atmosphere had to be carried much farther.

Earlier Mr. Fallon had said that equipment manufacturers had the same common purpose as the supply side, and there was a good case for getting closer together. He suggested that young men from the technical departments of gas undertakings should spend a week or two with the manufacturers in the drawing office and the works, and also see the plant started up at the customer's works. Such a system of liaison between the equipment manufacturers and the supply side would do a great deal of good. He was endeavouring to establish a similar liaison with American concerns for the exchange of young men for short periods, which he felt would be a means of encouraging both national and international goodwill.

MOULDED PATTERN PLATES

By JAMES TIMBRELL

Most of the expense in making a moulded pattern plate goes in the preparation of a full set of "all-the-same" master patterns, if this plate is to be moulded at one ram up. When using a smaller number than the total planned, "cutting out" and "bedding in" are necessary, and these require care and jointing technique if the finished plate is to produce true and symmetrical castings.

For flat patterns and those with a simple joint line, bedding in or laying on is comparatively easy to a pattern plate moulder, but for patterns where the joint line is of a more intricate nature, a complete set is usually considered essential to give certain results. Where master pattern expense need not be considered this is decidedly best, but where initial pattern cost, or the uncertainty of repetition orders, require economy, the use of a plaster transfer block can sometimes be used to show a considerable saving in pattern costs.

Fig. 1 shows a cast pattern plate with two rows of six castings each side a centre runner (a complete set of the castings is shown in Fig. 2). This plate is made from two master patterns and a transfer block, and the procedure is as follows:—Both master patterns have to be exactly alike, and are of the type shown at A in Fig. 3. To make the transfer block a pattern is placed level and square inside a suitable box (Fig. 4) and rammed up, as shown in Fig. 5, jointed down, and the space cast in plaster. After this has set the block is trimmed correct for strip, taper and joint line, etc., as shown at C. Two flat back moulds are rammed up in the pattern plate tackle. These boxes, of course, should be claywashed and reinforced to permit repeated rolling over and lifting off. Rectangular spaces are lightly marked off on the face of the moulds and positioned for space the transfer block will occupy. The first corner space is cut out to take this, and the block placed in position, checked for level and strips, and the master pattern is placed on the block and the appropriate space in the top cut through. The mould is closed and the open space rammed up "tight" in the usual way, and then the mould rolled over. The bottom is lifted off, the transfer block removed, which incidentally leaves the master pattern behind and correct for moulding joint line. The space under the transfer block is cut through, the mould closed, and the ramming up continued. The second lift off makes the first impression complete. The master pattern is left in place and the transfer block placed alongside the first impression, checked for linear correctness and horizontality. The

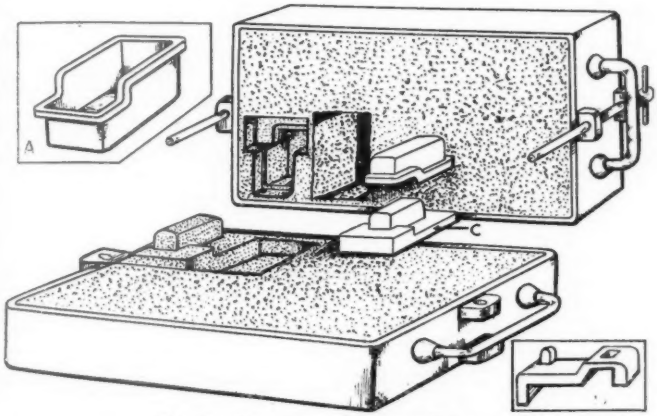

FIG. 3.—PATTERN AND MOULD DETAILS.

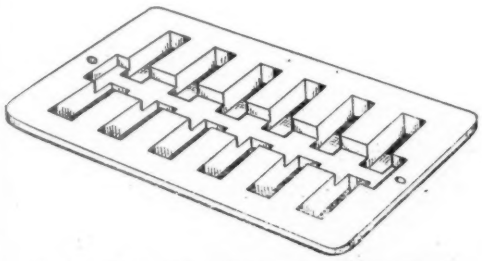

FIG. 1.—CAST PATTERN PLATE FOR TWO ROWS OF SIX CASTINGS.

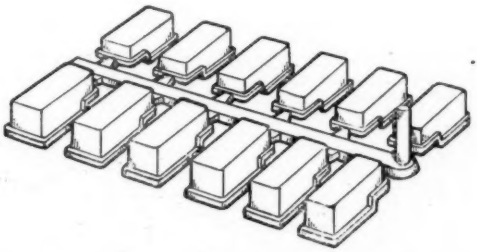

FIG. 2.—THE AS-CAST APPEARANCE OF THE CASTINGS.

Moulded Pattern Plates

cutting through, closing, ramming, etc., are repeated.

The object of leaving the first pattern in place is to ensure that the first impression does not break down with the subsequent ramming in this area, when the second ram up is complete. The first pattern is removed and the second left in place as shown in Fig. 6. The last rammed-up pattern is left in place at each sequence and the previous one moved forward till the mould is completed. It is then cast as usual with the thickness frame inserted as shown in Fig. 7.

For intricately jointed patterns, narrow, and of a type shown at B in Fig. 3, where two or three dozen are to be mounted, a transfer block to take a number of these, carefully set out, and in some cases made by the patternmaker, may be used. A larger number of patterns will be necessary for these narrow-type patterns and, of course, will reduce the number of times the cutting out and bedding in operations are done.

FIG. 4.—BOX FOR MAKING TRANSFER BLOCK.

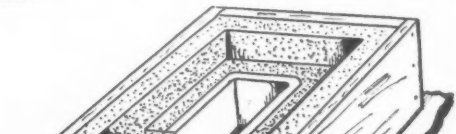

FIG. 5.—BOX SHOWN IN FIG. 4 AS RAMMED UP.

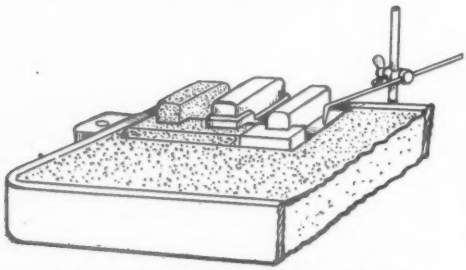

FIG. 6.—SHOWING CHECKING OF MOULD.

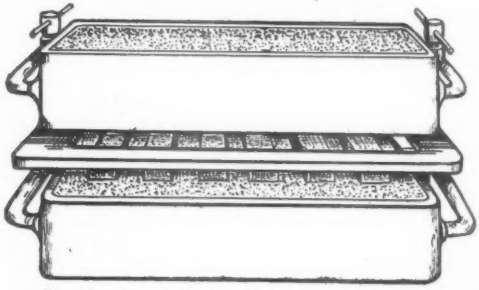

FIG. 7.—SHOWING THE USE OF THE THICKNESS PLATE.

NOTES FROM THE BRANCHES

FALKIRK SECTION.—The Annual Business Meeting was held on March 1, when it was stated that attendances over the last six meetings had constituted a record.

The election of officers took place, and Mr. William Montgomery, of Frederick Braby & Company, Limited, Glasgow, was elected President, while Mr. William W. Blair, of Falkirk, and Mr. John N. Reid, of Larbert, became senior and junior vice-presidents respectively. Two vacancies on the committee were filled by the election of Mr. D. Fleming and Mr. J. C. Leith. Mr. Goodwin called on Mr. G. C. Wilson, a past-President, to present a short Paper on "Pattern-making." In this a concise list of the requirements of a good pattern was given, showing where usually pitfalls were encountered, and the remarks were illustrated with examples of snags met with in practice, together with remedies employed to counteract them. The too frequent disregard by the engineer of the finer points in making a casting received a modicum of attention.

A discussion followed in which camber and its causes provided the main point of interest. The eventual finding was that composition of metal and casting temperature were the main factors in causing camber, while changes in ramming by the moulder also had an effect. Members voiced their appreciation of Mr. Wilson's remarks, after which the chairman summed up the discussion, and proposed the usual vote of thanks.

METALS AT HIGH TEMPERATURES

CONFERENCE AT THE ROYAL SOCIETY

Approximately 150 scientists recently attended a conference at the Royal Society to discuss various aspects of Metallic Creep at high temperatures. Sir Charles Darwin, Director of the National Physical Laboratory, Department of Scientific and Industrial Research, was in the chair. The scientists included physicists, engineers and metallurgists.

During the war years it was necessary for the scientists engaged in Government research establishments, Universities and industrial research organisations to concentrate on the immediate problems of wartime urgency with the result that there was little time available for that liaison and linking between persons and organisations working on related problems which is so valuable in accelerating overall progress and in avoiding duplication of effort. The development of new aero-engine designs, particularly jet-propelled types, led to extreme pressure on the production and testing of new alloys for use at elevated temperatures, and the subject of Metallic Creep seemed one in which a "gap" between theory and experiment might well have grown. It was to bridge any such gap and to re-establish liaison that Sir Charles Darwin had arranged the conference.

Introduction and History

PROFESSOR E. N. DA C. ANDRADE, one of the pioneer workers in this field, opened the discussion. Under the heading of "Introduction and History," he described briefly his early work on metallic wires which had suggested that "creep curves" were, in general, of similar form, and could thus be fitted, by a suitable choice of arbitrary constants, to an empirical formula which he had put forward in 1910. He explained the early ideas on the mechanism of creep and described the process of deformation by slipping along specific planes in the metallic crystal with the consequent formation of "slip bands" on the surface of the test specimen. The propagation of such slip along an atomic glide plane was illustrated by means of an ingenious model using wooden cylinders, which by their interlocking showed high resistance to sideways movement when in the regular sequence typifying a "perfect crystal," but which slid easily when one or two of the cylinders were out of place as in the two-dimensional representation of an atomic irregularity or fault. Professor Andrade explained that the formation of a slip was accompanied by strain hardening in the immediate neighbourhood so that the deformation proceeded by series of slips on successive planes each containing a fault.

MR. H. J. TAPSELL, of the Engineering Division of the National Physical Laboratory, described the equipment installed at that establishment for measuring creep rates down to 10^{-8} strain per hour. He described the creep rate as the most discriminating measure of the mechanical strength of a metal under stress at high temperature, and illustrated this by showing the wide divergence of creep rates at 450 deg. C. of some mild steels. He stressed the point that engineers are normally interested in very small amounts of creep over periods of thousands of hours and showed that the creep behaviour of a metal over a few hours gave little indication of the probable creep over thousands of hours. He illustrated the laws governing the creep rate changes with stress and time, applicable only to conditions involving continued decrease in creep rate with time. Under such conditions creep curves at various stresses had the same geometric form, and satisfactory equations for creep under complex stress systems had been developed. He described the deductions drawn from experiments on creep recovery and creep relaxation, and stated that X-ray studies of lattice structure changes during creep and associated phenomena were beginning at the National Physical Laboratory.

DR. OROWAN spoke on "Physical Theory" and paid tribute to the early pioneer work of Professor Andrade. He criticised current theories of the form of the typical time-extension curve under constant stress, and developed a novel theory, based on the conception that the activation energy of the glide process depended on the prior strain in a manner deducible from the stress strain relation determined under conditions of rapid loading. An equation for the time-strain curve was developed which was shown to agree closely with the behaviour of certain samples of copper and aluminium at a number of widely differing temperatures.

Metallurgist's Viewpoint

DR. ALLEN presented the viewpoint of the metallurgist on the control of creep resistance. He emphasised the need for developing the use of metals of high melting point, and showed how the creep resistance of available metals could be improved by control of grain size and softening temperature, and by the use of precipitation hardening. Reference was made to several factors which influenced the creep resistance of alloys in a profound but unexplained way and the practical necessity of a fuller understanding of these effects was brought out.

A general discussion was opened by SIR LAWRENCE BRAGG, who drew attention to the differences of outlook between theoretical physicists and engineers and expressed the opinion that studies from both viewpoints should be carried out, with contact and collaboration between them. He also drew attention to possible differences in the results of slip in the interior of the metallic grain and in the neighbourhood of the grain boundary.

Other speakers in the discussion included Dr. McCance, who described another theoretical formula for the time-strain curve, Dr. Pfeil, Dr. Smithells, Mr. Bucknall, Mr. Oliver, Mr. Conway, Dr. Chalmers, Mr. Chaston, Dr. Hume-Rothery and Dr. R. W. Bailey. In closing the meeting, Sir Charles Darwin said that the meeting had proved the need for engineers and physicists to collaborate more closely in this branch of work and that he felt sure that, in that connection, it had served a most useful purpose.

TUBE INVESTMENTS, LIMITED, have received an order for 73,219 cold-drawn steel boiler tubes for the Argentine Navy.

BASIC OPEN-HEARTH SLAGS

The principal phases that may occur in basic open-hearth tapping slags are lime, magnesio-wüstite, nagelschmidtite, di- or tri-calcium silicate, and apatite, with smaller amounts of monticellite, merwinite, and calcium ferrites. In the melting-down stage monticellite, or more rarely merwinite and wüstite-magnetite solid solutions, predominate in those slags in which no fluorspar has been used; in addition a phase also recorded is the properties which most closely resemble those of steadite. The chemical composition, optical properties, and mutual relations of the above phases occurring in a number of slags are given in a Paper entitled "Mineralogical Observations on Some Basic Open-Hearth Slags," submitted by S. O. AGRELL, B.A., Ph.D., F.G.S., to the Iron and Steel Institute, the author describing in detail the variations of phase assemblages from two casts. The variation of phase assemblages of these and other slags is summarised by plotting the different assemblages on the ternary diagram CaO-P_2O_5-SiO_2, and it is shown that they fall into definite fields on this diagram. With further study of the phase assemblages of slags the chemical composition of which are known this diagram, states the author, could be amplified so that the phase assemblages of basic slags could be predicted from their chemical compositions.

THE OFFICES of the British Welding Research Association are now removed from Buckingham Palace Gardens, London, S.W.1, to 29, Park Crescent, W.1.

THE FOUNDRY & ENGINEERING COMPANY (WEST BROMWICH), LIMITED, have appointed Kalcium, Limited, of Prague, as their agents for the sale of Acme continuous-drying stoves.

AN AUTOMATIC AIRLESS WHEELABRATOR ABRASIVE CLEANING PLANT INSTALLED IN THE FOUNDRY OF THE BRITISH BATH COMPANY, LIMITED, GREENFORD, MIDDLESEX.

LOW-FREQUENCY INDUCTION FURNACES

Mr. G. F. Alexander dealt with the subject of induction furnaces at the November meeting of the South African board of the Institute of British Foudrymen, over which Mr. H. Holdsworth presided. He dealt initially with the Kjellin furnace (1891), as representative of the cored type. Then followed some notes on the Ajax Wyatt brass melting furnace (1917)—a plant which achieved both a technical and commercial success. Passing on to the coreless induction furnace pioneered in the early 'twenties by Northrup, who successfully harnessed the high-frequency current for melting steel, the Author finally reviewed in some detail the attempts which had been made to utilise normal frequencies. He concluded his lecture by a demonstration designed to show that despite failures this problem was not insoluble, and that currents could be induced by means of which even copper, which has the lowest resistivity of all metals with the exception of silver, could be rapidly heated. When molten, the copper would have about 12 times the resistivity of the cold metal with which he dealt in his demonstration, and would therefore be capable, according to Esmarch, of absorbing about 3½ times the amount of energy (12), which means that it would heat up that much faster.

Owing to the very low impedance of the demonstration circuit (0.37 ohms empty and 0.32 ohms loaded) it is necessary to reduce the voltage by interposition of the welding transformer between it and the 220-volt mains. With the tappings used he took about 750 watts from the mains, including the energy lost in the welding transformer, which was about 250 watts, as it was by no means ideally suited to the job.

Thus the power applied to the demonstration circuit itself, which might be considered as a small mains frequency induction furnace, was only about 500 watts. The circuit was one of several constructed for the purpose of testing out certain theories regarding the characteristics to be expected of 50 cycle coreless induction furnaces generally, and more particularly to check up on several alternative methods recommended for evaluating the numerical values of the more intangible of the circuit constants as L1, L2 and M. It was subjected to various experimental tests at the University, when it was found that almost exactly half the power (at 50 cycles) expended in it reappeared as heat in the secondary; in other words considered as a furnace its electrical efficiency is 50 per cent.

Therefore as 500 watts were going into the circuit, 250 watts were being consumed in the secondary. In the case of the ring, its resistance could easily be calculated to be about 2×10^{-4} ohms and since—

$I^2R=W$, substituting for R. and W

Thus $I^2=250\div2\times10^{-4}=125\times10^4$

Therefore $I=1.100$ amps. approximately (R.M.S. value).

Hence the current flowing in the ring was about 1,100 amps.

If the current was allowed to flow for a time enough heat would be developed in the ring by the circulation of this current to raise its temperature above the melting point of the solder used to sweat the ends of the ring together, and they will spring apart. If this should happen at or near the peak of a current wave, there would be quite a considerable arc developed. It would be realised that just as the current in the primary circuit is alternating so is that induced in the secondary ring; therefore it could happen that the break might occur at a moment when the current flowing in the ring was zero; it could also happen that it broke at the maximum value of the current, which in this case was $1.40\times1,100=1,520$ amps., which was enough to cause quite a notable flash. Actually it was very unlikely to break at either maximum or minimum current, the chances being overwhelmingly likely that the break would occur at an intermediate point on the current curve.

Skin Effect

The apparatus was also able to demonstrate quite effectively the phenomenon of skin effect. If now a copper disc is inserted into the inductor coil in place of the ring and the current is switched on, it would heat up from the outside edge, as could easily be felt by the finger tips. Owing to the fact that copper is an excellent conductor of heat as well as electricity, the centre of the disc also warmed up fairly rapidly, but it could be felt that the outside edge was always the hottest part. Unfortunately this lecture room had not been wired for providing heavy currents, and it was not possible to increase the inducing current, otherwise the skin effect would be more apparent.

Although the demonstration circuit was only 50 per cent. efficient there would appear to be no great difficulty from the theoretical point of view in constructing a low-frequency coreless furnace with an electrical efficiency of 80 per cent. and better, when working under steady conditions and fed from 50 cycles mains, provided it were made large enough to accommodate at least 15 cwts. to 1 ton of metal. But the construction of a successful furnace demands more than the design of an efficient electrical circuit. For a good overall efficiency one had to consider the heat losses of the furnace which fall into two divisions; one more or less constant, being a function of the temperature of operation, and the other an electrical loss directly proportional to the power input; from which it becomes apparent that a good overall efficiency demands a high rate of power input in the case of the low-frequency furnace no less than in its high-frequency counterpart. Otherwise one found that the bulk of the heat input merely went to balance losses from the furnace, and the margin available for melting fresh material falls to a small percentage of the total energy input.

In its turn a high rate of power input demanded an efficient method of securing the inductor coil in the furnace frame as the mechanical stresses set up by

Induction Furnaces

the heavy currents circulating in the coil were much greater at normal frequency than they were at high frequencies, as these stresses were inversely proportional, other factors being equal, to the square root of the frequency. (They were, of course, also directly proportional to the power impressed on the coil.) If the coil were not securely fixed, it would very soon chafe its insulation to such an extent as to cause its breakdown with consequent short circuiting.

The lining of such a furnace also presented a very difficult problem. The thickness of the lining which separates the coil from the molten metal in the furnace hearth must be kept to an absolute minimum, because the power factor of the furnace depended on this, and because the condensers required for the correction of its power factor are by far the largest single item in the cost of such a furnace, even when designed for the best possible power factor. The cost of condensers was proportional to tan ϕ, so the table below would give some idea of the way this rises as the power factor, cos ϕ falls.

Cos ϕ	Tan ϕ
0.4	2.3
0.3	3.2
0.2	4.9
0.1	10.0

Having established the urgent need from the financial aspect for a minimum thickness of lining between coil and metal, it was necessary to give consideration to the stresses and strains, one might almost say to the "slings and arrows of misfortune," to which this lining will be subjected in use. If the furnace be intended to deal with iron or steel it would be subjected continuously for hours at a time to a temperature of 1,400 deg. to 1,600 deg. C. at its inner face, according to the type of metal charged, and there would be a watercooled coil at its back. From this coil, however well it may be fixed, there would in addition emanate a certain amount of vibration. Then just as with the coil mechanical stresses in the liquid bath were set up, the inevitable result of which is erosion of the lining. These stresses resulted in the repulsion and flow of metal towards the centre of the hearth, and were proportional directly in strength to the power impressed and inversely to the square root of the frequency. In fact, when everything was considered, the lining was probably the most important factor in use for the success or otherwise of the furnace. The Author's first choice for this exacting duty was a 2-in. sleeve of andalusite/fireclay—80/20—backed by about ¾ in. of comparatively loosely packed magnesia base insulating powder between the sleeve and coil. It remained to be seen how this would work in practice.

In spite of all the difficulties which have been described the Author was firmly of the opinion that the low-frequency coreless induction furnace would be a factor of importance in the future of the iron and steel industry, as it is in this field particularly that it showed promise from the electrical point of view of being able to melt material more cheaply and to provide better means for refining the material when molten, than any furnace in present use.

Discussion

MR. WARD asked the size of the biggest furnace in general use overseas for melting steel [in South Africa].

MR. ALEXANDER replied that steel melting was undertaken in units up to 5 tons capacity. This was actually a very big furnace and probably required 2,000 or more kilowatts to melt such a large amount. As a rule brass furnaces were fairly small. The Mint had a battery of several units of 60 kilowatts which melted about 600 lbs. in a 1½-hr. cycle, this being actually a very cheap method of melting.

Referring to a statement in the Paper regarding the high cost of high-frequency furnaces, MR. CARTWRIGHT pointed out that the Author had previously mentioned that it took 750 to 800 kilowatts to melt a ton of steel. Mr. Alexander explained that this figure referred to the old Kjellin furnace. The unusually high cost was in respect of the initial cost. He believed that the furnace at Vereeniging cost about £45 per kilowatt, which was a lot of money.

MR. TONGE said he understood that a furnace of the type installed at Vereeniging cost about a round figure of £20,000, of which the furnace itself accounted for approximately £3,000. The cost was not in the furnace but in the electrical equipment. The furnace came into its own during the war when so many expensive alloys were produced and had to go back as scrap. High-frequency furnaces gave the most efficient recovery.

MR. ALEXANDER expressed the opinion that the efficiency of recovery depended to some extent on the condition of the swarf. If the swarf was highly oxidised and rusty or contaminated in any way, there was bound to be trouble, but melting losses were lower with this type of furnace than any other. At the Mint they had considerable difficulty in using up their turnings till they installed an electric furnace. It was very hard to make an accurate estimate of melting losses unless very careful allowance was made for the amounts of water, oil, etc., clinging to the swarf. Since he first saw high-frequency furnaces in operation in Sheffield, he felt sure that they could be redesigned to operate with ordinary mains frequency. With a mains frequency furnace, if it could be obtained, the cost would probably be less than half that of a high frequency unit, because it eliminated the necessity for an expensive generator, a very much smaller condenser battery was required, and the running costs were less.

MR. TONGE asked Mr. Alexander whether he considered that the high-frequency furnace would ever be a serious competitor to the foundry in the manufacture of steel castings.

MR. ALEXANDER said it was very difficult to foretell future developments. During the war radio transmitter valves must have been made in much larger quantities and presumably would be much cheaper when they returned to the civilian market. It might be found in a couple of years that a 500-kilowatt valve could be made for a small sum and would do away with the

alternator altogether. If the cost of the electrical equipment could be brought down by using transmitting valves instead of high-frequency alternators, it was possible that this method of melting might be much cheaper in a few years.

MR. G. BURROW said he had had some experience in operating the Ajax-Wyatt furnaces at the Mint. The original units were 600-lb. furnaces. They had a usable or tappable charge of about 600 lbs., and it was estimated that about 400 lbs. of metal was retained in the furnace after each tap. Some larger furnaces were subsequently installed, which had a capacity of 900 lbs. per tap, retaining about 400 lbs. to maintain the electric current in the furnace. When melting leaded brass they had to handle very large quantities of scrap from the machine shop. Tests were made for the soluble oil and water in this swarf, which were eliminated as far as possible. Figures over a period showed that for a short ton the average consumption was 250 kilowatts. A figure of 180 kilowatts was given in Robiette's book. The high-frequency furnace was used overseas not only for steel, but to his knowledge a small unit had been installed in the Canadian Mint for melting gold. Many laboratories were equipped with very small high-frequency furnaces for experimental work. A big use overseas was for melting nickel silver, for which a high temperature was required.

Wear of Linings

The PRESIDENT said he understood from the Paper that the wall from the crucible to the core was very thin. The agitation set up by the electric current must cause excessive wear in the lining. What was a good lining to withstand this wear in the case of steel?

MR. ALEXANDER explained that his observations on the wear of linings referred more especially to low-frequency melting. At higher frequencies there was no noticeable turbulence. They were actually working on very pure materials at Vereeniging and using a silica lining in powder form, which was rammed up. This was bonded with a small percentage of boric acid. His company expected trouble with the lining of the low-frequency furnace they were building. Discussing the problem of increasing the resistance in such a furnace, the lecturer said that having a much lower resistance in the secondary, the charge could not absorb the same amount of power. There were various ways of overcoming this difficulty. The method Esmarch suggested was by increasing the diameter proportionately as the resistance decreased. The disadvantage was that a furnace to be efficient would have to hold 5 or 6 tons of metal, and an input of at least 1,000 kilowatts would be required. To build such a furnace would be a tremendous undertaking.

MR. BULLOCK said that, whereas the first furnace mentioned seemed to him to be an induction resistance furnace, reference was made subsequently to what he took to be a pure induction furnace because there was no secondary winding; *i.e.*, it had a coil which was purely a solenoid with an air core, and when the metal was put in a magnetic flux transmitted through the transformer passed through the metal. The formula given subsequently by Mr. Alexander could not apply to magnetic heating but only to electric heating. The phenomenon of heating on the outside could easily be explained. Any conductor carrying electric current had a higher flux density near its surface than centrally. As regards the power factor, Mr. Bullock maintained that the idle constituent was what actually did the heating. In South Africa current was paid for in kilowatts, but in some countries it was by k.v.a., in which case the power factor was not considered.

MR. ALEXANDER did not agree with Mr. Bullock's contention that the heating effect demonstrated was due to hysteresis. He pointed out that copper rings and discs had been used in the circuit of the demonstration apparatus, so that the heating effect could only be due to electric currents induced in them. He agreed, however, that when melting magnetic materials hysteresis loss did occur. The question of power factor could be approached from two different points of view, as an inductive reactance and also as a measure of flux leakage. The greater the leakage the lower the power factor. He did not think Mr. Bullock was right in the conception that an idle current could do any heating in the furnace. It was waste power as far as the secondary circuit was concerned.

ALUMINIUM AND THE AUTOMOBILE ENGINEER

At the London general meeting of the Institution of Automobile Engineers, held on February 5, at the Institution of Mechanical Engineers, S.W.1, DR. E. G. WEST (Director of the Light Alloy Development Association) read a Paper entitled "Aluminium and the Automobile Engineer." This Paper dealt with aluminium in all its forms, wrought, cast, sheet, extruded and pressed. It detailed all of the recognised alloys, giving in almost every case tables of the forms in which each was available, treatment required, tensile properties, etc., suggestions for the increasing of die life, the most suitable sections for the extruded form, machinability, strength and application of welded joints, and data on riveting, together with a section on possible applications in automobile production.

NICKEL CONTROL ENDS

The Minister of Supply has revoked the order made in 1941 which controlled the acquisition and disposal of nickel. This metal had very important uses in wartime, but, now that the war is over, world supplies are adequate for all peacetime needs, and there is no longer any need to control supplies. Consumers can now obtain nickel without having to apply to the Directorate of Non-ferrous Metals for a licence. It is pointed out, however, that it will still be necessary to obtain a Board of Trade licence for any supplies imported from abroad.

£50,000 FOR METALLURGISTS

FOR ADVANCEMENT OF KNOWLEDGE

Gratifying evidence of a concern for the advancement of metallurgical knowledge and for its proper application to the needs of industry is afforded by the announcement of the Mond Nickel Company's offer to make available £50,000 for additional, special training of metallurgical students. The offer, made to the five metallurgical institutes: The Iron and Steel Institute, the Institution of Mining and Metallurgy, the Institute of British Foundrymen, the Institute of Metals, and the Institution of Metallurgists, will enable awards of at least five substantial Fellowships to be made annually for the next fifteen years.

The particular aim of this offer is to help towards the speedier and fuller application of the results of research work to the needs of industry, and thus to bridge the gap which tends to develop between pure research and industrial practice. It is hoped by this means ultimately to provide, within the executive ranks of the metallurgical industry, a proportion of men with a metallurgical training; and also, among those who bring their technical knowledge and skill to the execution of these policies, men who can appreciate the wider significance of the work upon which they are engaged.

If the donors' suggestions are accepted, the Fellowships will be used to provide opportunities for travel to study the industry in other countries, for training in administration, or for the study of industrial economics.

That they will attract a larger number of promising students to a seriously under-manned profession, though a secondary consideration, is not least among the possible benefits afforded by this generous offer.

Text of Letter

The following is the text of a letter sent by the Mond Nickel Company, Limited, to the metallurgical institutes aforementioned:—

DEAR MR. PRESIDENT,—As with many others in the metal producing and using industries, my company has been concerned at the serious shortage of metallurgists which became so obvious during the war years and which is likely to exist for some time in the post-war period. That this shortage was clearly recognised some time ago was evidenced by the setting up of the McCance Committee on the Supply and Training of Metallurgists by the Advisory Council of the Department of Scientific and Industrial Research, and it has, of course, been given much thought and attention by the metallurgical institutes. The interest of the institute has, during my own period of office as President of the Institute of Metals, been demonstrated by the establishment of the Joint Education Committee.

Another deficiency, of broader implication, which became evident during the war period, was in regard to the prosecution of research by British industry. Much has been said and written on this subject in recent months, and there are indications that interest in the question has been widely aroused. In the metallurgical field this necessity for increasing the quantity and quality of research is at least as marked as in other sections of industry, and it is to be hoped that present interest in the subject will result in an increase in the research carried out and the number of men trained for carrying out research.

While in no way seeking to diminish the enthusiasm which seems to be spreading for increasing research, I feel sometimes that inadequate attention is being given to what is in my view of at least equal importance, namely the provision of means by which the results obtained in the research laboratory can be utilised in industry. Indeed, I am not sure that it is not in this direction rather than in that of the carrying out of research of adequate quality that this country has in the past been somewhat behind other countries, such as America and Germany. Both questions, that of increasing research and that of securing the prompt and effective utilisation of research results are related to a third; that of the availability for executive and administrative posts in industry, of men able to appreciate the technological significance of research and its results. The importance of assisting metallurgical students to fit themselves for the highest posts in industry is briefly touched upon in the McCance Committee's report.

My fellow directors and I have been seeking a way by which we might assist in meeting some of these needs, particularly in encouraging some of the best of our scientifically-minded youth to direct their attention to, and continue in, the metallurgical field, and also in helping to meet the demand in the industry for men of sufficient calibre and suitable understanding of scientific and technical matters. We believe we can best do so by making available, during these critical post-war years, a number of Fellowships for award annually to individuals of particular promise who, having received an adequate academic training, desire an opportunity of broadening their experience or training. For this purpose my company is prepared to covenant to make available during the next seven years such annual sums of money as will provide a total of £50,000. I have to ask whether the metallurgical institutes would be willing to receive these moneys and co-operate in expending them in awarding Fellowships having for their aim the furtherance of the above objects.

Since it is the years in the immediate future that would seem to matter most, our thought is that the total sum and any accrued interest should be expended during the next 10 to 15 years. It is estimated that in this way at least five Fellowships of an average value of about £700 (*e.g.*, one at £850, two at £750 and two at £650) would be available each year.

It is suggested that these Fellowships should be awarded to men of at least University Degree standard who best satisfy the "awarding authority" that, in following a proposed plan of additional training or study (preferably suggested by the applicant himself), they would better fit themselves to meet the needs of the British metallurgical industry. The intention would not be to award the Fellowships only, or even mainly, for further research. It seems likely that adequate provision will be made in this direction from

(*Continued on page* 299.)

FOUNDRY CONTROL

In a lecture which DR. H. STEINHARDT gave to the South African branch of the Institute of British Foundrymen, he presented a very complete review of all the various methods used to assess the properties of metals, alloys, and castings. He concluded his remarks by including some notes on control of production, of which the following is the substance.

Purity of Materials

With regard to non-ferrous materials, the composition of the most used alloys, as far as concerns copper-base alloys and whitebearing metals, is specified within certain limits, including allowance for impurities. A number of foundries have been using, since the introduction of Emergency Regulations by the Controller of Non-Ferrous Materials, ingot materials supplied to them, and have had to rely on the manufacturer of the ingots. As most of these ingots are produced from scrap metals and sometimes shavings, it is easy to realise the danger of contamination which exists if the scrap is not very carefully selected, and the remelted ingots are not under permanent analytical control. It is evident when one is using, *e.g.*, phosphor-bronze ingots, which are supposed to consist of 10 to 11 per cent. tin, 0.3 to 0.5 per cent. phosphorus, the remainder copper, and the phosphorus content is only 0.1 per cent., and if there is lead, zinc, aluminium, etc., present exceeding the allowed impurity limit of only 0.5 per cent., that the test will not be up to expectations, and the life and wear of castings manufactured from material of this kind will be below standard. The same applies to the presence of lead exceeding 0.5 per cent. in manganese bronzes or of zinc in white bearing metals, or to the presence of other elements above a very small impurity margin in copper, which have a very detrimental effect on the electrical conductivity and the heat resistance for boiler work. These are only a few examples out of a very wide range.

Perfect Working, Moulding and Casting Methods

Even if it be assumed that moulding is in every respect perfect, one has to remember that the solidification process of many alloys is very different; in other words, one has, for example, to make provision for heavier risers and more cleverly distributed feeders for manganese and aluminium-bronze castings than for phosphor bronze or gunmetal. If this factor be neglected, castings are exposed to piping, etc. While melting the metal one has to prevent overheating, undue oxidation and gas absorption. It is necessary to degas and to deoxidise the melt properly prior to casting, and to ensure that no segregation in alloy occurs, that there is the right casting temperature and that unnecessary turbulence during pouring is avoided. The use of pyrometers for temperature control is strongly recommended.

Behaviour of Materials

The rate of cooling has a very great influence on the crystallisation of many alloys. Chill castings have a very different structure compared to sand castings. Additional heat-treatment with the re-grouping of the structure of the crystals causes considerable changes in the physical properties. These facts have to be adapted to the individual cases to obtain an optimum of strength.

During fabricating processes, such as rolling, drawing, etc., considerable hardening occurs combined with an increase of tensile strength. For example, in the manufacture of brass sheets, bars or wires, one distinguishes between soft, soft-bright, quarter-hard, half-hard, hard, extra-hard and spring-hard. These are all variations within alloys of the same chemical composition, depending on the amount of working done with them, including intermediate stages of annealing.

Practical Conclusions

The cessation in the manufacture of war supplies must necessarily decrease the demand for production, which was running at the highest pitch. Fortunately in this country, contrary to Europe, there are no battle scars and devastation, but consequently there is no reconstruction work, as is the case in Britain and on the Continent. The expected big expansion of the building trade and the railway programme concerns chiefly the steel industry, which, in spite of a very big war expansion, has still a very wide margin for increased production owing to the fact that in pre-war times approximately two-thirds of the South African steel consumption was imported. The replacement of machine tools, which appears extremely necessary, will probably be covered to a very large extent from overseas; the same applies to vehicles, cars, and probably to agricultural implements. According to personal experience, many distributor firms and agencies, which absorbed large quantities of locally manufactured products, are looking forward once again to obtaining their imported articles. Let us hope that the gold-mining industry—the backbone of this country—is willing and able to place their orders at or above the pre-war standard.

Anticipating more or less the fact that there will be a reduced volume of work, there seems to be a tendency, at least by some firms, to secure orders at any cost, and price-cutting is used as the main weapon. But when the reduction in prices falls below a certain economic level, such offers can only be made by the use of inferior materials or by a lower standard of craftsmanship in the production. As an example take phosphor-bronze castings, P.B.I. (or 2B8). It is impossible to manufacture this alloy within the exact limits of specification from the scrap at present available. The cost of the raw material alone (copper, tin and phosphor copper) before starting production is already 1s. 0½d. per lb.; but any firm which does not concern itself so much about compliance with the chemical analysis and uses scrap metal at 6½d. per lb. or even shavings at 4d. per lb., is in a position to make cheaper offers for castings. Needless to say under such circumstances the consumer, who is only keen to secure the lowest prices, is in the long run not the winner but the loser.

Industry had already to try to overcome another

(*Continued on page* 300.)

SOUTH AFRICAN FOUNDRYMEN IN LONDON

A group of London foundry organisations were the hosts of several prominent South African industrialists at present visiting this country. The function was held in the "Gondoliers" room at the Savoy Hotel and Mr. R. B. Templeton presided. The principal guest was Mr. D. Lion-Cachet of the East Rand Engineering Company, Limited, Germiston, and a past-president of the South African branch of the Institute of British Foundrymen. Last-minute illness prevented the attendance of Mr. A. Velchik, of the City Iron Works, Pretoria, but he was represented by Mr. Pollock, the secretary of that company. Mr. Koppel, who represents several British foundry equipment houses in Johannesburg, was also present.

Growth of Ironfounding in South Africa

Mr. Lion-Cachet, in a truly statesmanlike speech, described the growth of the iron foundry industry in the Dominion. This was, and still is, based on gold, and the first casting to be made was a cast-iron washer to be fitted on to the wooden frames used in ore treatment. Later came the making of spare parts for tube and ball mills in white and grey iron. Then the first world war threw South Africa on its own resources, and striking developments were achieved. Between the wars there was a steady consolidation, to be followed once again by extraordinary activity.

It seems that South African manufacturers were responsible for a substantial percentage of the small arms ammunition requirements of the Allies, the special machinery for its production having been made locally.

Promising Future

Speaking of the future, Mr. Cachet envisaged an even greater volume of business between the United Kingdom and South Africa. "When we made spades," he said, "you made ploughs—when we made ploughs you made tractors, and so it will always be." He punctuated his speech with many wise saws, such as, "You in Britain must be true to your traditions, but not bank on them."

The chairman's health was proposed by Mr. Barrington Hooper, C.B.E., and supported by Mr. A. R. Knowles, O.B.E.

WALLWORK GEARS, LIMITED

With a view to further development, Wallwork Gears, Limited, Red Bank, Manchester, 4 has been acquired by J. Stone & Company, Limited, of Deptford. Mr. F. A. G. Powell-Jones, commercial director of J. Stone & Company, Limited, has been elected chairman, and Mr. A. J. S. Brown (works director of J. Stone & Company, Limited) is managing director. The other directors are Mr. P. A. Peterson and Mr. B. H. Lancaster. Mr. Sydney Wallwork has retired from the Board but will remain available to the Company for consultation. It is intended to develop considerably the mechanical handling and foundry equipment department, which remains under the management of Mr. W. Tait.

METALLURGY DIVISION OF THE ROYAL AIRCRAFT ESTABLISHMENT

Last week our representative visited the Metallurgy Division of the Royal Aircraft Establishment at Farnborough. Under the guidance of Dr. Bruce Chalmers, the visit started at the foundry. This is quite a sizable shop in which many years ago there was cast the first aero engine cylinder head ever made in aluminium. It uses coke-fired crucible furnaces and melts both ferrous and non-ferrous metals. In the press shop adjoining, there is a complete set of sand-testing apparatus, but the bulk of this shop is taken up with a rolling mill, large presses, and heat-treating furnaces.

The welding laboratory is unusually interesting, as not only is every type of welding undertaken and the product tested, but even work is done in relation to corrosion of welds. Throughout the whole of the departments corrosion is well to the fore as a major factor in the safety and life of planes. For instance, in the petrol tanks, the few drops of water which accumulate there are especially corrosive, and in the chemical laboratory there was an exhibit showing the inclusion in a specially provided compartment of a small bag of chromate to inhibit corrosion from this source. Long life tensile tests at elevated temperatures are carried out under ideal conditions.

The Temperature Factor

The room temperature, controlled at 72 deg. F., is a factor which allows the maintenance of a plus or minus 0.5 deg. C. control on the actual test pieces. Other laboratories are busy on a similar problem but at normal temperatures on accelerated sea-water corrosion tests on light alloy strips under load. It is interesting to see how a slow drip along the faces of the test piece cuts a channel and rapidly brings about failure. These tests are reproducible. The X-ray department is devoting more attention to atomic structure than to normal internal defect examination. In the metallographic department, real progress is being made in the structural examination of alloys at high temperatures, and the young metallurgists are to be congratulated in adopting the microscope to this purpose.

Single crystals of tin are being made and examined by physicists for obtaining fundamental knowledge of atomic structure. Now that the routine work upon the metallurgy division is of less volume than during the war, a reduction in staff is envisaged and this will release for industry a number of well-trained young scientists. Foundry owners desirous of reinforcing their scientific staff should write to Dr. Bruce Chalmers at Farnborough, Hants.

TOY DIES

We are indebted to Mr. T. Shanks, of Cruikshank & Company, Limited, Denny Iron Works, Scotland, who tells us that "Amateur Moulder" should apply to H. B. Sale, Limited, Progress Works, Summer Lane, Birmingham; Edward Pryor & Son, Limited, Broom Street, Sheffield, 10, and Barton Die-Casting Service, 10, Clifton Avenue, Manchester.

SPECIAL ACT CONCERNING INCOME TAX

ALLOWANCES FOR MACHINERY AND PLANT

The Income Tax Act, 1945, passed by the late Coalition Government for operation in the post-war period, is to come into force from April 6, 1946.

The Act concerns new allowances, off income tax assessments, for buildings, plant and machinery, so that the position as regards depreciation allowances is much altered and should be noted.

By this part of the scheme there will be a special allowance called the "initial allowance" for new buildings, being 10 per cent. of the capital expenditure, followed by a yearly allowance called the "annual allowance" of 2 per cent., so that the expenditure will be returned against tax in a period of 45 years. But while the "initial allowance" only applies to new buildings, the annual allowance will apply for any buildings fifty years old or less, the position being that as regards these, the 2 per cent. will be allowed a life of up to fifty years; for example, take a building 25 years old, the 2 per cent. will operate for each of the next 25 years. This buildings allowance only applies to industrial buildings, such as mills, factories, etc., and similar premises, not to retail establishments (including repair work), a rough idea of those attracting the allowance being those which get the quarter valuation for local rates. At the same time it should be noted that the special depreciation allowance which has obtained (Factory Act, 1937) for depreciation of mills, factories, etc., is to cease, but anyone wishing this to continue can arrange to do so up to a period of five years.

Machinery and Plant

For this new allowance (*i.e.*, the "initial allowance") for machinery and plant, all concerns, including professions and retail establishments, so far as any machinery or plant used for the purpose of the business will participate, and it applies to second-hand machinery as well as new. This allowance will be 20 per cent. of the capital expenditure, and this will apply not just to expenditure on machinery and plant, first laid down in the post-war period, but each time machinery or plant is provided.

The existing wear and tear allowances will continue, including not only the agreed rates which apply to particular trades, but also as regards the extra percentage which has been given to all industries, and furthermore, this "plus" percentage, which has been one-fifth, will become one-fourth. For example, a basic rate of 20 per cent. (*e.g.*, motor vehicles attract 20 per cent.) will now total 25 per cent. (basic 20 per cent., plus one-fourth, 5 per cent.), instead of 24 per cent. (basic 20 per cent., plus one-fifth, 4 per cent.).

The position really is that by these increased allowances, all capital expenditure will be allowed earlier against tax payments, the object being for replacements to take place earlier. At the same time the old "obsolescence allowance" is discontinued, and in its place emerges what is now called "the balancing allowance," but whereas under the former rules the allowance only applied where machinery, etc., was replaced, this new allowance operates whether machinery is replaced or otherwise. But arising out of this, if on a sale of the scrapped machinery the amount realised comes to more than the written-down value, this excess will be considered a profit, and so chargeable with tax; but it might be useful to note that if the amount is used for the renewal of machinery, etc., the "balancing charge" will not apply. If a taxpayer prefers that the present obsolescence allowance should continue instead of the balancing allowance, it can do so for machinery, etc., provided before April 6, 1946, and replaced after that date, if the Inspector is notified.

Particular Points

The special allowance rules (Factory Act, 1941) for exceptional depreciation of buildings, machinery or plant (provided since January, 1937) have been enlarged so that not only as originally enacted the allowance will apply where the machinery, buildings, etc., have been sold or have become redundant, but in cases where the buildings, machinery, etc., have been retained, but have fallen in value.

£50,000 FOR METALLURGISTS

(*Continued from page* 296.)

other sources. Nor would it be the intention necessarily that the Fellowships should be awarded only to men who had shown brilliance in the carrying out of research, though naturally these would not be excluded. Further, the Fellowships need not be confined to those who are qualified metallurgically, but could be used to attract into the metallurgical field men qualified in other sciences (*e.g.*, physicists, chemists, engineers, etc.), who might, if enabled to gain suitable experience, meet a need in the metallurgical industry.

Reference has been made in the McCance Committee's report and elsewhere to the helpfulness of travelling scholarships. It might be expected that the majority of the Fellowships considered here would be of this type, but the possibility of a training in this country in administration, industrial economics, or some other aspect of business or industry, should not, we think, be excluded.

If the above proposal commends itself to the institute, the matter could perhaps be explored further in discussion between representatives of the institute and my company. Possibly the Joint Education Committee or some sub-committee of this could in the first place meet us, when details, such as the best means of making the moneys available, the machinery for financing the Fellowships, the conditions of award, etc., could be discussed.

I should add in conclusion that this proposal has the fullest support, not only of my own Board, but also of that of our parent company, the International Nickel Company of Canada, Limited, and its chairman and President, Mr. Robert C. Stanley.

Trusting it will be found acceptable to the Institute, I remain, etc.,

W. T. GRIFFITHS,
Chairman and Managing director, the Mond Nickel Company, Limited.

UNIFICATION OF ENGINEERING STANDARDS

The Ministry of Supply and of Aircraft Production have now released for publication a Report prepared by the Conference held in Ottawa in September and October, 1945, under the auspices of the Combined Production and Resources Board, on which the U.K., Canada and the U.S.A. are represented, on the subject of the Unification of Engineering Standards.

The Report records agreed recommendations on a very wide range of standardisation subjects, including various types of screw threads, limits and fits in engineering and drawing practice.

Detailed agreeed recommendations are recorded in the matter of acme threads, buttress threads and instrument threads, whilst substantial progress is recorded in the consideration of special threads for high-duty studs in light alloys, pipe threads and screw threads for gas cylinders. The most outstanding recommendations are those concerned with the general problem of arriving at a common screw-thread form and associated ranges of diameters and pitch for general engineering use in countries employing the inch system of measurement. The adoption of these recommendations would solve a problem which has very wide commercial considerations and which has been outstanding for the best part of 100 years. As in all matters of standardisation, there will inevitably be adjustments to be made in existing practice in all the countries concerned, but the view was unanimously expressed by the delegates to the Conference that if a common standard is to be achieved, then the recommendations made in the report represent the solution, which involves the minimum overall readjustment.

The Report also records substantial progress in the matter of unified standards for limits and fits in engineering and for drawing practice. In view of the importance which the Government attach to these questions, the British Standards Institution have been invited by the Minister of Supply and of Aircraft Production to give early consideration to the recommendations of the Report, in consultation with the industrial interests affected.

Copies of the Report are already being circulated to a number of professional institutions and trade associations concerned in these matters, but further copies may be obtained on application to the British Standards Institution, 28, Victoria Street, London, S.W.1.

WASTERS DUE TO CONTROL

BY "CORONER"

The following note deals with some wasters which at first were rather mysterious, but which were ultimately tracked down to a lack of control. By lack of control is meant a breakdown in an otherwise foolproof system whereby much of the work is removed from individual moulders and standardised. One particular case concerned a number of fairly "chunky" dry-sand castings which were very rough and unsightly. As these had never before given trouble from this cause, and were being made by the same moulder, it was thought that the fault must be due to lack of control.

The first possible variable examined was that of casting temperature, for if cast from a high-duty iron, at a high temperature, some such results may be found. As a record was kept of casting temperatures—taken by an optical pyrometer—these were examined and nothing unusual noted. As other castings off different patterns came through the fettling shop, a number of these were found suffering from the same defect. The next variable examined was the blackwash, as this could be responsible for the trouble encountered. The blackwash, instead of being mixed by individual moulders according to their own ideas, was mixed at a central station and distributed where required.

The type of mixer employed depended on a pump to circulate the wash and thus keep it to the correct consistency. This pump had become defective and was being repaired. Thus the circulating system was idle for some time. A notice was placed on the tank calling attention to fact that all blacking should be well stirred before use, as the solid material had a tendency to settle out of suspension.

This was duly noted in the majority of cases, but in isolated instances the moulder received a container of "blackwater" instead of the blackwash of required density, and consequently, instead of making a refractory face on the mould, simply left the sand grains exposed to the heat of the iron, resulting in the partial fusing of some of these and thereby producing a rough dirty casting.

On other occasions, when it has been necessary to stop the mechanical mixing, it has been one person's responsibility to ensure that the moulders receive blackwash correctly mixed, and thus avoid a number of wasters due to this aspect of "lack of control."

FOUNDRY CONTROL

(*Continued from page* 297.)

handicap, which is outside its control and cannot be settled without Government assistance, namely, that here in the Union one has to pay much higher prices (approximately 40 per cent.) for certain raw materials than in England, though the same materials are manufactured either in the Union of South Africa or on her very doorstep. In this respect the price for local tin ingots (Zaaiplaats) is 3s. 9d. to 4s. per lb., while the English price for tin of the same purity (99 to 99.75 per cent.) is below 2s. 9d. per lb. Rhodesian electrolytic zinc costs in the Union £45 per short ton, while the English price for the same commodity and from the same producer is £31 5s. for the long ton, equal to approximately £28 per short ton. Similar conditions are prevailing for other materials.

The conclusion to be derived from these facts is that as a counter-measure South Africans will have to convince of, prove to and, if possible, educate the consumers to the superiority of a controlled production, the goods of which on account of improved wearing qualities will render a longer and better, and consequently, less expensive service than apparently cheaper products, which may be of a lower quality.

GERMAN STEEL FOUNDRY METHODS

Mr. R. A. Gezelius, of the United States Ordnance Department, reporting to the Combined Intelligence Objectives Sub-committee, states that basic melting practice was used in all of the plants visited. Electric furnace steel was preferred for all castings. Open-hearth steel was used only for castings which could not be poured with the electric furnace facilities available, usually castings over 8 to 10 tons pouring weight. None of the plants visited employed any methods of slag control other than visual examination by the melters in charge.

Practically all medium and large steel castings were moulded by hand in chamotte. This practice has been used in Germany for decades and is well known in the United States. Two foundries in America are using this practice for a limited part of their current production. Mechanical moulding is limited to small castings (usually under 2 cwt.) which are produced in quantity. Modern mechanised foundries were noted only at the Annen Plant of Ruhrstahl A.G. and at Skodawerke (Pilsen).

Several men were interviewed concerning the lack of mechanisation in Europe. In each instance the answer was that the labour rates were so low, compared to the interest charges on the capital expenditures required for mechanisation, that it would be unprofitable to instal the equipment. The Annen plant of Ruhrstahl A.G. was said to be the only foundry which did not use the chamotte practice. This plant used a variation of the Randupson process (cement-bonded sand). The variation consisted of using a mixture of one part cellulose to 40 parts water rather than pure water as the wetting agent. This cellulose product was obtained from I. G. Farben under the trade name of "Alkylene." The material looked like small wood shavings. It was said to aid in obtaining more collapsible moulds and to eliminate "burning-in" at the gates and re-entrant angles. The castings examined had a good surface. None of these castings was very large (5 tons maximum) and the material may not be suitable for large castings.

The Annener plant also used an unusual moulding material for the small castings (under 2 cwt.) produced in green sand in the mechanised foundry. This consisted of silica sand bonded only with dextrine. The material was used for both moulds and cores and gave satisfactory results on the small castings produced. The amount of dextrine employed varied slightly with the size of the castings, but the average addition was approximately 5 per cent. dextrine.

Centrifugal Castings

The practices employed in the production of centrifugal castings on the vertical machines and the small horizontal machines were similar to those in use in the U.S. The practice used on the large horizontal machines is different from any now in use in America. The same practice is used at Bochumer-Verein in the production of gun tubes. The equipment consists of a forged and heat-treated cylindrical mould (0.35 C, 1.5 Cr, 0.25 Mo) which is rotated in a water jacket on roller bearings. This cylindrical mould is driven by a variable speed D.C. motor at 600-1,200 r.p.m., the speed being adjusted for the diameter of the tube.

Prior to pouring the casting the surface of the mould is covered with a layer of fine, dry warm sand. This sand varies in thickness from 0.5 to 2 cm., depending upon the size of the casting being produced. The proper distribution of this sand layer is one of the most important features of the process. To produce this uniform layer of sand a pipe with a slit across the top is inserted into the mould cavity. This pipe contains a weighed amount of sand evenly distributed throughout its length. The machine is started and when it is up to speed the pipe is turned and the sand permitted to run into the mould. Centrifugal force holds the sand against the mould in a layer of even thickness. As soon as the mould is prepared a weighted amount of steel is poured into the mould cavity and the mould is rotated until solidification is complete. The time required for complete solidification varies from 18 to 25 mins., depending upon the size of the tube. The total time required to produce one tube, including mould preparation, varies from 30 to 40 mins.

These machines will produce tubes with a maximum length and diameter of 3.6 meters and 600 mm., respectively. The minimum diameter which can be produced is 60 mm.

It was stated that by using this sand lining on water cooled moulds, it was possible to produce 2,000-3,000 castings per mould.

Inspection

None of the foundries visited tested any armour castings radiographically. The only radiographic equipment noted was that at Skoda (used for light alloys only) and that at Ruhrstahl A. G. (used only on small aircraft parts). The usual inspection consisted of visual examinations only. A few foundries used destructive tests on pilot castings and the common oil and whiting tests on a few production castings. An examination of the gating and heading practices employed on armour castings leads to the belief that few of these castings would pass the radiographic requirements now required by the Ordnance Department.

SMALL AMOUNTS OF ALUMINIUM IN STEEL

A spectrochemical method for the determination of small amounts of aluminium in steel is described by ROBERT SPIERS, PHILIP FISCHER, and KENNETH L. PROCTOR in "Industrial and Engineering Chemistry," December, 1945. It is for steels with a range from 20 to 500 micrograms of Al per sample. Colorimetric procedures proved unsuitable because of the presence of interfering ions which could not be completely eliminated. A method was developed employing a mercury-cathode separation and a final spectrographic procedure of sparking a concentrated solution of aluminium.

BORAX CONSOLIDATED, LIMITED, have returned to their London address, at Northgate House, 20-24, Moorgate, E.C.2.

IMPORTS AND EXPORTS OF IRON AND STEEL

BOARD OF TRADE RETURNS FOR 1945

Returns just published by the Board of Trade contain figures of Britain's overseas trade in 1945. The following tables give the imports and exports of iron and steel and manufactures thereof. Figures for 1938 are shown in the first column for purposes of comparison.

Total Exports of Iron and Steel.

Destination	Year ended December 31		
	1938	1944	1945
	Tons	Tons	Tons
Eire	55,713	15,147	32,443
Channel Islands	7,416	—	919
Palestine	8,070	3,185	24,474
British West Africa	49,740	8,013	21,787
Union of South Africa	231,075	17,162	75,807
Northern Rhodesia	20,574	6,132	3,308
Southern Rhodesia	36,209	9,220	18,338
British East Africa	25,928	3,248	9,737
British India	158,607	18,868	28,061
Burma	18,510	—	3,543
British Malaya	66,582	—	1,033
Ceylon	26,027	3,413	7,233
Hong Kong	23,592	—	—
Australia	170,834	8,709	6,200
New Zealand	131,878	6,525	10,002
Canada	85,395	660	4,645
British West India Islands	44,250	1,120	5,928
Anglo-Egyptian Sudan	8,290	2,094	3,277
Other British Countries	21,918	2,164	6,079
Soviet Union	4,349	6,295	2,020
Finland	17,571	—	2,162
Sweden	11,813	—	†
Norway	20,264	—	30,208
Iceland	657	462	5,169
Denmark	87,221	—	9,597
Germany	33,805	—	†
Netherlands	51,533	—	24,014
Dutch East Indies	27,300	—	—
Dutch West India Islands	2,464	291	4,727
Belgium	20,256	30	23,666
France	13,384	214	108,804
Portugal	7,708	2,793	13,331
Portuguese East Africa	14,220	175	1,278
Spain	7,763	1,685	2,383
Egypt	34,404	9,413	30,295
Iraq	25,740	1,918	15,499
Iran	110,380	57,302	49,450
China	22,129	358	360
Japan	6,954	—	—
U.S.A.	2,187	27,307	340
Brazil	16,989	90	3,358
Argentine	79,350	178	6,309
Other Foreign Countries	106,153	5,768	46,582
	1,915,202	219,939	642,366

† Exports, if any, included in the figure for "Other Foreign Countries."

PRELIMINARY REPORTS received from official channels indicate that there are stocks of about 1,200 to 1,300 tons of tin concentrates in Lower Burma. The current production is negligible. An officially appointed inspection committee—nominated by the Lower Burma tin and wolfram mining industry—is at present engaged on a survey and report on the condition and requirements of the mining properties.

Total Imports of Iron and Steel.

From	Year ended December 31		
	1938	1944	1945
	Tons	Tons	Tons
British India	155,633	174,672	90,314
Canada	117,374	112,597	65,709
Other British Countries	5,633	574	26,676
Sweden	89,795	13	6,881
Norway	33,774	†	1,536
Germany	96,343		†
Belgium	273,680		3
Luxemburg	58,601	—	—
France	257,347	—	—
U.S.A.	200,692	1,475,569	117,411
Other Foreign Countries	55,398	727	4,967
Total	1,344,270	1,764,152	313,454
Iron ore and concentrates—			
Manganiferous	62,282	—	3,250
Other sorts	5,101,867	2,172,244	4,073,539
Iron and steel, scrap and waste, fit only for the recovery of metal	632,203	31,808	180,537

Exports of Iron and Steel by Products.

Product	Year ended December 31		
	1938	1944	1945
	Tons	Tons	Tons
Pig-iron	93,941	2,560	1,088
Ferro-alloys, etc.—			
Ferro-tungsten	517	16	159
Spiegeleisen and ferro-manganese	5,197	150	31,724
All other descriptions	1,048	617	873
Ingots, blooms, billets and slabs	9,743	336	581
Iron bars and rods	3,197	262	1,871
Sheet bars, tinplate bars, wire rods and bright steel bars	22,149	1,314	8,248
Other steel bars and rods	102,003	9,354	72,142
Special steel	4,933	2,337	4,668
Angles, shapes and sections	67,405	8,016	46,714
Castings and forgings	1,618	441	373
Girders, beams, joists and pillars	33,471	4,782	26,076
Hoop and strip	37,377	1,108	9,043
Plates ¼ in. thick and over	130,959	37,631	93,453
Black plates	14,538	955	3,175
Black sheets	63,513	1,248	2,356
Galvanised sheets	146,933	583	1,529
Tinplates	319,308	15,434	27,169
Tinned sheets	1,410	798	808
Terneplates	4,325	2,410	3,671
Decorated tinplates	4,368	486	1,000
Cast-iron pipes up to 6 in. dia.	48,928	2,001	11,532
Do., over 6 in. dia.	42,963	3,387	11,663
Wrought iron tubes	219,973	49,383	78,349
Steel rails	106,000	18,195	59,182
Sleepers and fishplates	25,382	2,699	19,052
Other railway material	26,771	4,008	6,274
Wire	55,181	1,907	11,534
Wire manufactures	29,485	4,419	8,297
Nails, tacks, etc.	3,806	5,521	5,084
Rivets and washers	8,536	1,194	2,418
Wood screws	2,512	2,216	2,070
Bolts, nuts, and metal screws	17,533	3,210	6,784
Stoves, grates, etc.	9,150	1,849	3,168
Sanitary cisterns	2,812	209	379
Fencing material	5,130	65	701
Anchors, etc.	11,956	2,484	5,551
Springs	3,931	604	1,601
Hollow-ware	10,702	4,800	19,672
All other manufactures	216,498	20,950	52,282
Total	1,915,202	219,939	642,366

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Length	22 inches
Width	8½ inches
Thickness	3¾ inches

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THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM

NEWS IN BRIEF

THE CENTENARY OF Connal & Company, Limited, pig-iron and metal warehouse keepers, was celebrated in Glasgow on February 28 after having been delayed from 1940.

WELDING EQUIPMENT, LIMITED, is being wound up voluntarily. Mr. Herbert Lomax, 83, Bridge Street, Manchester, 3, is the liquidator. All creditors have been paid in full.

PHŒNIX FOUNDRY, LIMITED, of Johannesburg, have received an order to mechanise the foundry of James Barwell (S.A.), Limited, which on completion will be the largest of its type in the Union.

AVELING-BARFORD, LIMITED, announce that shareholders have taken up over 99 per cent. of the recent issue of 500,000 ordinary 5s. shares, offered at 18s. each. The small balance has been allotted to the company's executives and employees.

THE THREE BLAST FURNACES at Dinsdale, the property of the Linthorpe-Dinsdale Smelting Company, Limited, which have not been operated since 1931, are to be dismantled for scrap. The work will extend over a period of 18 months to two years. Two steel bridges are to be demolished and five miles of railway track taken up. The completion of the work will remove a well-known landmark.

FOR THE FIRST TIME two students attending the same technical class have won bronze medals for obtaining the highest marks in the country in examinations in foundry practice and patternmaking. They are Mr. F. Rodgers, who took the examination in foundry practice, and Mr. A. Searby, who took intermediate patternmaking. The prize winners were among those to whom certificates were presented at the Applied Science Department recently.

DORMAN, LONG & COMPANY, LIMITED, Middlesbrough, have received a contract from the Director, Royal Ordnance Factories, and the Ministry of Supply for 10,000 steel wagon bodies for the home railways. The work is being undertaken with the help of 27 sub-fabricators in the structural engineering and allied trades in all parts of the country. Approximately 40,000 tons of steel will be used in the construction of the wagon bodies, which are of welded construction.

FISHER & LUDLOW, LIMITED, manufacturers of metal pressings and stampings, etc., propose to acquire additional permanent capital for the post-war programme in the form of 4½ per cent. cumulative redeemable preference shares of £1 each, and a meeting has been called for March 25 to create 800,000 of the new shares. The company proposes to issue 500,000 of the new shares and to make them available for subscription by holders of the existing preference shares and ordinary stock. There will be no letters of right.

THE MONTHLY INFORMATION SHEET of the British Standards Institution for January lists amongst "new work started" the following:—Circular saws for woodworking (revision of B.S. 411); pneumatic tools and accessories (revision of B.S. 673); malleable cast-iron pipe fittings (revision of B.S. 143 and B.S. 1,256), and dust extraction plant (revision of B.S. 893). Amongst draft standards circulated for comment are:—CH 3,363 Draft B.S. for domestic heating stoves (openable type) with or without boilers, and their installation; CH 3,405 Draft B.S. tests for vitreous enamel finishes, and CH 3,529 Draft B.S. for shower partitions for use in schools.

IN ADDITION TO THE daily work in steelworks' laboratories, research into steel rolling processes is being undertaken in the Metallurgy Department of Sheffield University, said Sir Charles Goodeve, Director of the British Iron and Steel Research Association, when addressing members of the Sheffield Society of Engineers and Metallurgists. It looked as if that would develop into a metal flow research station administered by the B.I.S.R.A., with very substantial control by the makers of rolling mills and other equipment, he added. That would be a very good example of the policy of full co-operation between the makers of the equipment and the users of the steel.

ADDRESSING THE National Union of Manufacturers on "Scientific Research and Industry," Sir Edward Appleton, secretary of the Department of Scientific and Industrial Research, said it was the firm that used science every day that was going to be able to use the big spectacular advances when they came along. The D.S.I.R. wanted to work in partnership with industrialists, with the ultimate object of benefiting the community as a whole. They could not do that without knowing what industry's problems were, and therefore they welcomed any means of collaboration which would facilitate the formulation of these problems, since to formulate a problem was half-way to finding its solution.

PIG-IRON WARRANTS

To many of the younger generation, the term "Pig-iron Warrants" means just nothing. It has to them been relegated to the limbo of the archaic. How the system worked was revealed by Mr. J. Gray Buchanan, chairman of William Jacks & Company, Limited, when speaking at the centenary dinner of Connal & Company. It appears that each of Connal & Company's warrants consisted of 300 tons of No. 1 Scotch pig-iron and 200 tons of No. 3. All these had to be G.M.B., that is, "good merchantable brands." The warrants issued by the Middlesbrough office of Connal's consisted of 500 tons of Cleveland No. 3. During the last war, the pig-iron wrapped up in warrants was a distinct boon, for at one time they reached 1,000,000 tons. For storage ½d. per ton per week was charged by the merchant. The system was abandoned in 1914. An attempt was made to revive the warrant market in 1926, but no Government help was forthcoming, and later in the year pig-iron was being imported from the Continent at exorbitant prices. It is interesting to note that warrants for tin, copper, lead and spelter were taken over by the Government in 1939 as a useful national asset.

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PERSONAL

MR. P. H. SPRAKI has been appointed the South African agent for Molyneux Foundry Equipment Company, Limited, of London.

MR. E. G. WILKINSON has been appointed Regional Controller of the Ministry of Supply and Aircraft Production in Northern Ireland in succession to MR. S. O. HICKS.

DR. H. J. VAN DER BIJL has been elected president of S.A.F.E.M.A., the South African engineers employers' federation, in succession to Mr. J. M. Osborne.

MR. G. M. WELLS has been appointed London manager of Hopkinsons, Limited, of Huddersfield, and will be in charge of the sales and service organisation covering Southern England.

MR. JAMES MUIR, foreman, Dalzell Steel Works, Motherwell, has retired after completing 48 years' service with Colvilles, Limited. He has the longest record of service as a foreman in the history of the works.

PROF. A. BURSTALL has taken up his duties as head of the Department of Mechanical and Marine Engineering at King's College, Newcastle-upon-Tyne. He was formerly Professor of Engineering at Melbourne, Australia.

MR. J. K. ANDERSON, for many years chairman and managing director of Fairbairn Lawson Combe Barbour, Limited, textile and general engineers, etc., of Leeds, and its associated companies, has resigned from these boards.

MR. ARTHUR WHITELEY, managing director of the Glanmor Foundry Company, Limited, Llanelly, has, in addition, been appointed managing director of Thomas & Clement, Limited, Morfa Engineering Works, Llanelly, in succession to the late Mr. W. E. Clement.

MR. ROBERT W. JOHNSON and MR. FRANK O. JOHN have been appointed to the board of Cammell, Laird & Company, Limited. Mr. Johnson is the son of Sir Robert S. Johnson, chairman and managing director of the firm. Mr. John has been with the company for over 30 years, and holds the position of naval architect and technical manager.

A RESERVOIR OF TRUSTWORTHY MEN

The Corps of Military Police, constituted of picked men of reliable character, is obviously being reduced in strength, and the Secretary of their Old Comrades Association, Corps of Military Police, Mitchett, near Aldershot, will be pleased to hear from foundry owners having vacancies. They are not veterans seeking jobs such as are normally filled by the Corps of Commissionaires, but positions where a combination of initiative and trustworthiness are paramount.

OBITUARY

SIR GERVAIS RENTOUL, K.C., Metropolitan police magistrate at West London Police Court since 1934, who died on March 7, was Director of the British Ironfounders' Association, 1933-34.

MR. THOMAS LEE HALE, who was formerly associated with his brother, Mr. W. Edgar Hale, in the firm of Hale & Hale (Tipton), Limited, blackheart malleable ironfounders, died recently. He was 55.

MR. W. C. HOWE, a director of Cox & Danks, Limited, iron and steel scrap merchants, etc., of Park Royal Road, London, N.W.10, died recently. He was 49 years of age and had been with the company for 24 years. Mr. Howe had been a director for the past 10 years and had been in control of the Swansea office.

MR. THOMAS CHADWICK, chairman of the National Council of the National Union of Foundry Workers, died recently, aged 71. He had held executive office in the union since its inception in 1920, and, with one brief interval, had been chairman of the Council during that period. Tom Chadwick showed outstanding qualities as a trade union leader, and he was widely respected by all with whom he came in contact. The funeral was at Manchester on Friday last.

CONTRACTS OPEN

Any date given is the latest on which tenders will be accepted. The address is that from which forms of tender may be obtained.

Chippenham, April 5—Providing and laying cast- and wrought-iron water mains, etc., for the Calne and Chippenham Rural District Council. Ross Hooper & Harvey, engineers, Dallas Chambers, Chippenham, Wilts. (Fee £1, returnable.)

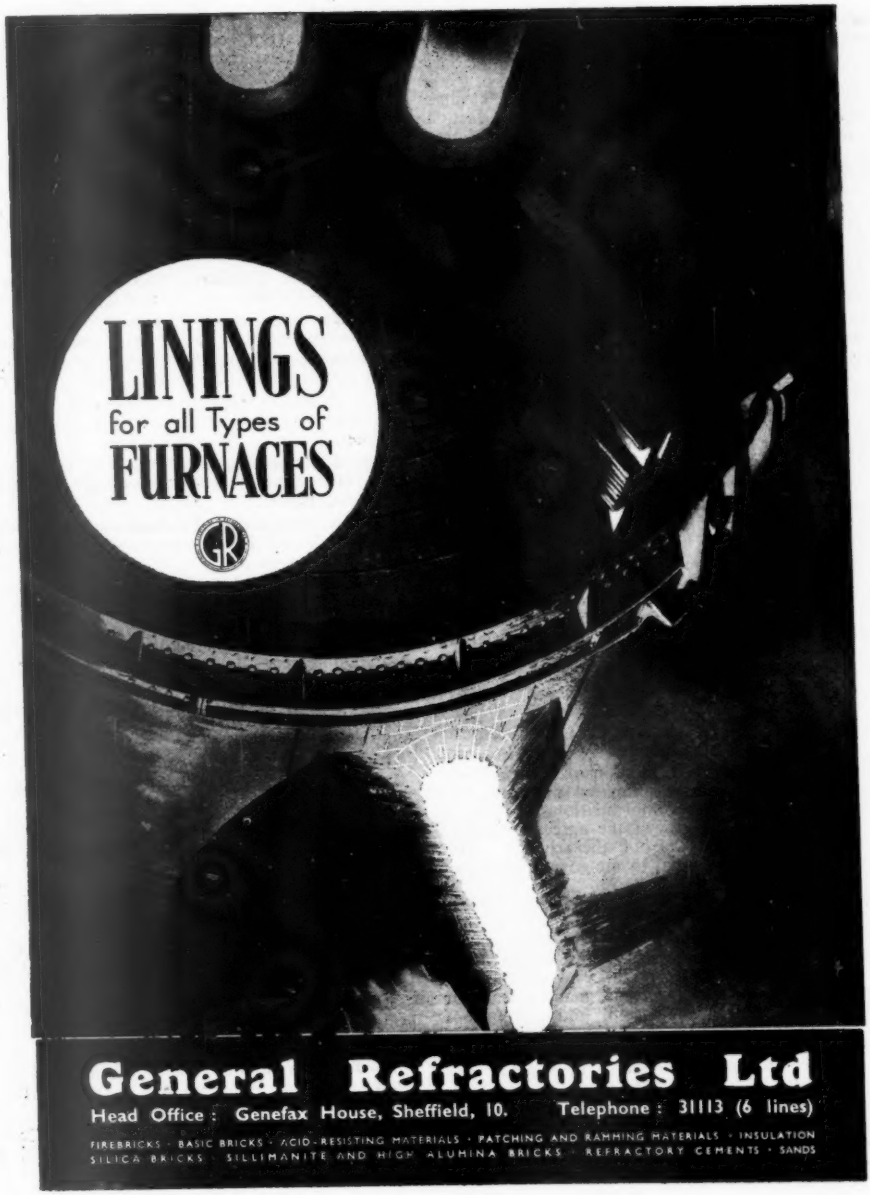
Grenoside, March 20—Iron castings, tools, etc., during the year ending March 31, 1947, for the Wortley Rural District Council. Mr. J. Gregory, engineer and surveyor, Council Offices, Grenoside, Sheffield.

LIGHT ALLOYS RESEARCH SCHOLARSHIP

A research scholarship of the value of £400 per annum and tenable for two years has been offered by the Aluminium Development Association to encourage and facilitate research in the application of light alloys to ship construction. The scholarship will be administered by a committee of the Institution of Naval Architects and it is hoped to make the award in September, 1946.

Full particulars of entry, which closes on July 31, can be obtained from the Secretary, Institution of Naval Architects, 10, Upper Belgrave Street, London, S.W.1.

THE WARTIME ARRANGEMENT made by the Government on behalf of industry in general for the use of copyright music in factories has lapsed, and factory owners continuing to have music performed on their the Performing Right Society, Copyright House, 33, Margaret Street, London, W.1.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Raw Material Markets

IRON AND STEEL

Activity at the steelworks and foundries ensures full absorption of pig-iron production and, in fact, a good many consumers are pressing for bigger allocations. This, of course, could only be accomplished by robbing Peter to pay Paul. Outputs cannot be increased until fuel is more plentiful, and the best that can be done is to distribute available supplies of pig-iron as equitably as possible.

The position in regard to supplies of semi-finished steel for the re-rolling trades shows no improvement. The sheet trade is reasonably well supplied with bars, but mills engaged on small and special sections, merchant bars and strip are not getting billets in tonnages which are sufficient to maintain maximum outputs. All available supplies of defective billets and crops are promptly taken up, but there is still a deficiency which can only be met by imported supplies, which of late have been coming to hand in very meagre quantities.

Specifications for light sizes figure conspicuously in the orders recently booked for the plate mills. A rising home demand is supplemented by much bigger offerings of export business than the rollers can accept, and the present state of supply and demand suggests that these conditions are likely to continue throughout the year. Orders for joists and sections are also on a rising scale, while the sheet makers already have extensive bookings for the second half of the year. Tonnages of steel required for the coal mines are steadily rising, and although moderate tonnages of railway material are being shipped abroad, a future limiting factor will be the urgent requirements of the home railways, which are in need of extensive repairs and renewals.

NON-FERROUS METALS

Following their meeting in London on March 7, the International Tin Committee intimated that they had put into final form the recommendation to Governments (required by Article 3c of the agreement) as to the continuation or otherwise of the scheme. This recommendation is confidential to the governments that are parties to the agreement.

Copper supplies continue to be somewhat difficult. On the other side of the Atlantic production is being hampered by strikes at a number of large smelters.

In the House of Commons recently Mr. Janner asked the Minister of Health whether, in view of the fact that copper sheet and strip were as good as lead for such parts as flashings, weatherings and damp-proof courses in building, and were currently only about half the price of lead which, unlike copper, was in short supply, he would, in the interests of quicker and cheaper building, take appropriate steps for encouraging the adoption of copper in building. Mr. Bevan, in reply, said he had already issued one instruction on this subject and further instructions would be issued shortly.

Mr. A. Chester Beatty, chairman of the Mufulira Copper concern, commenting on the outlook for copper, said he regarded the short-term prospects as uncertain, but, taking a long view, he declared himself as distinctly optimistic and expressed the opinion that large quantities of new copper should be required for a long time to come.

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Merchiston Foundry, 113, St. Vincent Street, Glasgow—£10,000. W., J., and R. Walker.

Dexray Engineering Company, 64, Cross Street, Manchester—£600. G. Sussman and C. Morris.

Woodrow Metals, Tweedside Place, Stonehouse, Plymouth—£10,000. B. J. Woodrow and F. G. White.

Joe Holmes (Metals), Pit Lane, Barkerend Road, Bradford, Yorks—£10,000. W. H. Empsall and J. Holmes.

Dryad Metal Works—£5,000. W. H. Pick, Walterway, Hoby, near Melton Mowbray; R. Peach, and A. J. H. Binns.

British Engineering Productions (Portsmouth), 23, Railway View, Portsmouth—£1,000. B. Peters and H. J. Masterton.

Davelan, Leyland Street Works, Derby—Engineers, machinists, etc. £1,000. J. H. Davis, L. B. Whelan, and B. N. Purdy.

Thorne Engineers (1946), South Parade, Thorne, near Doncaster—£3,000. G. Gravil, J. H. Beevers, and J. W. Wilson.

Nu-Enamel (1946), Hadrian Works, Haltwistle—£5,000. W. C. Richardson, 11a, Felton Avenue, Whitley Bay, subscriber.

Brentwood Metal Industries—£10,000. E. R. McColgan, 2, Boars Tye Road, Silver End, near Witham, Essex, subscriber.

Carridine & Miles, 75, Milk Street, Birmingham—General and mechanical engineers, etc. £4,000. C. J. Carridine and S. Kornfeld.

Frank Armfield, 1, Leadenhall Street, London, E.C.3—Engineers. £2,000. M. B. and B. Waddell, L. A. and J. G. Gainsboro.

Hadrill & Horstmann, 145, High Street, Guildford, Surrey—Engineers, etc. £2,000. J. Diamond, G. C. T. Hadrill, and F. G. Horstmann.

B. W. D. King (Chalford), 7, New Square, London, W.C.2—Engineers, founders, etc. £10,000. B. W. D. and K. M. G. King.

Martins Aluminium Solder, G.W.R. Sidings, Wood Lane, London, W.12—£1,000. W. Martin, P. J. O'Leary, and H. B. Williamson.

Burdon & Miles, Westpole Avenue, Cockfosters, Barnet—Manufacturing engineers and tool makers. £6,000. H. P. Burdon and G. P. Miles.